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State Publications and Regulations

REGULATION FILING AND PUBLICATION

1. Regulation Chapter, Number & Heading:

780 CMR

2. Name of Agency:

**THE MASSACHUSETTS STATE BUILDING CODE
STATE BOARD OF BUILDING REGULATIONS & STANDARDS**

3. This document is reprinted from the Code of Massachusetts Regulations and contains the following:

This is the

**Seventh Edition of the Massachusetts State Building Code
(One and Two Family Dwelling Code)**

as adopted by the

**State Board of Building Regulations and Standards and filed with the
Office of the Secretary of the Commonwealth**

Under the Provisions of Massachusetts General Laws, Chapter 30A, § 6, and Chapter 233, § 75,
this document may be used as evidence of the original documents on file with the Secretary of the Commonwealth.

Compiled as in full force and effect:

1/1/2008

BUILDING CODE 7TH ED.

BC7



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780 CMR 51.00 ADMINISTRATION FOR SINGLE AND TWO FAMILY DWELLINGS
780 CMR 52.00 DEFINITIONS
780 CMR 53.00 BUILDING PLANNING FOR SINGLE AND TWO FAMILY DWELLINGS
780 CMR 54.00 FOUNDATIONS
780 CMR 55.00 FLOORS
780 CMR 56.00 WALL CONSTRUCTION
780 CMR 57.00 WALL COVERING
780 CMR 58.00 ROOF-CEILING CONSTRUCTION
780 CMR 59.00 ROOF ASSEMBLIES
**780 CMR 60.00 CHIMNEYS, FIREPLACES AND SOLID FUEL-BURNING
APPLIANCES**
780 CMR 61.00 ENERGY EFFICIENCY
780 CMR 62.00 MECHANICAL ADMINISTRATION
780 CMR 63.00 GENERAL MECHANICAL SYSTEM REQUIREMENTS
780 CMR 64.00 HEATING AND COOLING EQUIPMENT
780 CMR 65.00 EXHAUST SYSTEMS
780 CMR 66.00 DUCT SYSTEMS
780 CMR 67.00 COMBUSTION AIR
780 CMR 68.00 CHIMNEYS AND VENTS
780 CMR 69.00 SPECIAL FUEL-BURNING EQUIPMENT
780 CMR 70.00 BOILERS AND WATER HEATERS

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**780 CMR 71.00 HYDRONIC PIPING
780 CMR 72.00 SPECIAL PIPING AND STORAGE SYSTEMS
780 CMR 73.00 SOLAR SYSTEMS
780 CMR 74.00 FUEL GAS
780 CMR 75.00 PLUMBING ADMINISTRATION
780 CMR 76.00 GENERAL PLUMBING REQUIREMENTS
780 CMR 77.00 PLUMBING FIXTURES
780 CMR 78.00 WATER HEATERS
780 CMR 79.00 WATER SUPPLY AND DISTRIBUTION
780 CMR 80.00 SANITARY DRAINAGE
780 CMR 81.00 VENTS
780 CMR 82.00 TRAPS
780 CMR 83.00 GENERAL REQUIREMENTS
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780 CMR 85.00 SERVICES
780 CMR 86.00 BRANCH CIRCUIT AND FEEDER REQUIREMENTS
780 CMR 87.00 WIRING METHODS
780 CMR 88.00 POWER AND LIGHTING DISTRIBUTION
780 CMR 89.00 DEVICES AND LUMINAIRES
780 CMR 90.00 APPLIANCE INSTALLATION**

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780 CMR 91.00 SWIMMING POOLS (Electrical Requirements)

**780 CMR 92.00 CLASS 2 REMOTE-CONTROL SIGNALING AND POWER LIMITED
CIRCUITS**

**780 CMR 93.00 REPAIR, RENOVATION, ALTERATION, ADDITION, DEMOLITION AND
CHANGE OF USE OF EXISTING ONE AND TWO FAMILY
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780 CMR 94.00 - 99.00 RESERVED

780 CMR 100.00 REFERENCED STANDARDS

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780 CMR 120.00 APPENDICES

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The *Seventh Edition, Massachusetts Building Code* (780 CMR), consists of both a basic building code (the *Massachusetts Basic Building Code*) and a stand-alone one-and two-family dwelling code (the *Massachusetts One- and Two-Family Dwelling Code*).

The technical content of the *Massachusetts Basic Building Code* is based on the 2003 International Code Council® (ICC®) *International Building Code*. The technical content of the *Massachusetts One-and Two-family Dwelling Code* is based on the 2003 ICC *International Residential Code*. Extensive technical changes have been made as a result of reviews by the Massachusetts Department of Public Safety (the Department), Board of Building Regulations and Standards (BBRS) and technical advisory committees, and also as required by Massachusetts General Laws and specialized Codes and Regulations.

SEVENTH EDITION, MASSACHUSETTS BUILDING CODE FOR ONE- AND TWO-FAMILY DWELLINGS (780 CMR)

FOREWORD

The *Seventh Edition, Massachusetts Building Code* (780 CMR) consists of two volumes; one volume addressing all building uses except one- and two-family detached dwellings and a second volume addressing only one- and two-family dwellings.

The *Seventh Edition, Massachusetts Basic Building Code* (780 CMR) volume addressing all building uses except one- and two-family detached buildings is based on the ICC 2003 *International Building Code* (IBC-2003) with significant Massachusetts modifications.

The *Seventh Edition, Massachusetts Building Code for One- and Two-Family Dwellings* (780 CMR) volume addressing only one- and two-family detached buildings is based on the ICC 2003 *International Residential Code* (IRC-2003) with significant Massachusetts modifications.

The chapters of the two-volume building code set are numbered consecutively from 1 to 120, with chapters 1-50 being dedicated to that volume of the building code addressing all building uses except one- and two-family detached buildings and Chapters 51-99 dedicated to that code volume addressing only one- and two-family detached dwellings.

Chapter 100 and Regulations 110.R1 through 110.R-6 (Chapter 110) and Appendices 120.A through 120.Z (Chapter 120) are shared with both volumes of the *Seventh Edition, Massachusetts Building Code* (780 CMR).

Chapter 100 is the Referenced Standards chapter; Regulations 110.R-1 through 110.R7 address, with modification, the same subjects as the *Sixth Edition, Massachusetts State Building Code* address in its Regulations Section (R- 1 through R-6). Appendices 120.A through 120.Z address, with modification, most subjects addressed in the *Sixth Edition, Massachusetts State Building Code* (most of the Sixth Edition Appendices A-K, redefined alphabetically) but with additional appendices acquired as a result of utilizing the ICC IBC and IRC as the bases for the *Seventh Edition, Massachusetts Building Code* (780 CMR).

Where Massachusetts requirements are different than requirements of the baseline IBC-2003 and IRC-2003, every effort has been made to identify such differences using **bold and italicized print** or in the case of entire chapters unique to Massachusetts simply so identifying such at the beginning of the chapter, but because Massachusetts does not just adopt unaltered versions of the IBC and the IRC the reader is cautioned to always utilize the *Massachusetts State Building Code* when designing and constructing/reconstructing buildings and structures in Massachusetts.

The *Seventh Edition, Massachusetts Building Code* (780 CMR), being a two-volume code, will be implemented in stages, with the *Seventh Edition, Massachusetts Building Code for One- and Two-Family Dwellings* (780 CMR), being implemented first.

As the *Seventh Edition, Massachusetts Basic Building Code* (780 CMR) volume addressing all building uses except one- and two-family uses is in final development as of August 1, 2006, the Building Code for all building uses except one- and two-family detached buildings will remain the *Sixth Edition, Massachusetts State Building Code* until further notice.

In recognition of the time periods involved in the planning, design and construction of buildings and building-related projects, and in order to effect an orderly and equitable transition between the sixth and the seventh editions, the State Board of Building Regulations and Standards will implement a policy regarding continued use of the current *Sixth Edition, Massachusetts State Building Code* while the new *Seventh Edition, Massachusetts Building Code for One- and Two-Family Dwellings* (780 CMR) is also implemented (please refer to the Department of Public Safety/Board of Building Regulations and Standards web page for such guidance—www.mass.gov/DPS).

PURCHASING

The Secretary of the Commonwealth is the “legal keeper of the record” for all Codes of Massachusetts Regulation (CMRs) and court-certifiable versions of CMRs can only be obtained through the Secretary of the Commonwealth. As such, the Massachusetts Building Code may be purchased by visiting the State House Bookstore located in the State House building in Boston, Massachusetts or by calling the bookstore at 617-727-2834 (to order online, also see <http://www.sec.state.ma.us/> and select “Statehouse Bookstore/Publications and Regulations”).

AMENDMENT PROCESS

Pursuant to M.G.L. c. 143, § 97, 780 CMR is subject to change by amendment. Amendments shall be proposed on forms made available at the Department of Public Safety and also found in Appendix 120.P of the *Seventh Edition, Massachusetts Building Code* (780 CMR).

Proposals are presented at a public hearing where the Board of Building Regulations and Standards (BBRS) hears testimony both for and against such proposals. Ultimately, when the BBRS adopts a proposal such adopted amendments to 780 CMR become effective when promulgated and first appear published in the bi-weekly *MASSACHUSETTS REGISTER*, issued by the Secretary of the Commonwealth (Publications and Regulations Division).

All proposals for amendment to 780 CMR must be received at least 60 days prior to the public hearing date. Changes that are voted approved are issued on a cycle determined by the BBRS.

The BBRS is mandated by law to convene public hearings to entertain changes to the code a minimum of twice each calendar year: in May and November. Other public hearings may be scheduled as necessary.

Anyone wishing to present a code change should contact the Department of Public Safety/Board of Building Regulations and Standards at:

One Ashburton Place, Room 1301
Boston, MA 02108

It is the responsibility of the code user to check the *MASSACHUSETTS REGISTER* to determine if amendments have been issued against 780 CMR or any other Construction Code (Electrical, Plumbing and Gas, Fire, Architectural Access, Elevator, etc.) of the Commonwealth.

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PREFACE

Introduction

Internationally, code officials recognize the need for a modern, up-to-date residential construction code addressing the design and construction of one- and two-family dwellings. The *Massachusetts Residential Code for One- and Two-Family Dwellings* is designed to meet these needs through model code regulations that safeguard the public health and safety and consider dwelling affordability in all communities, large and small.

This comprehensive, stand-alone residential construction code, based on the ICC IRC-2003, has been modified to reflect requirements of the State of Massachusetts, and otherwise incorporates approved changes from the 1999 code development cycle, establishes minimum regulations for one- and two-family dwellings using prescriptive provisions.

Development

On April 22, 1996, the ICC Board of Directors established the ICC/NAHB Task Force, charged with the examination of performance options of the CABO *One and Two Family Dwelling Code*. The Board further stated that the “purpose is to identify the issues (including the process of code development after 1998) and develop an action plan to resolve the issues.”

Subsequently, the ICC/NAHB Task Force recommended to the ICC Board that the “ICC develop and maintain a stand-alone residential code that will cover the construction of detached one- and two-family dwellings and multiple single-family dwellings (i.e., townhouses) not more than three stories in height with separate means of egress. This code is to be called the *International Residential Code for One- and Two-Family Dwellings*”. (NOTE: the Massachusetts variant of the IRC does not address multiple single family dwellings. Regulations for such are found in the *sixth edition of the Massachusetts State Building Code*, and ultimately will be found in the *seventh edition of the Massachusetts Basic Building Code* when available.

A code drafting committee was formed by the International Code Council. The intent of the code drafting committee was to develop a draft of a comprehensive residential code that is consistent with and inclusive of the scope and content of the existing model building codes and the *International One- and Two-Family Dwelling Code*.

The technical content of the 1998 *International One- and Two-Family Dwelling Code*, the other *International Codes* (including the *International Building Code/First Draft*) and the latest building codes promulgated by BOCA, ICBO and SB CCI was the nucleus for the development of this document. Other sources of relevant technical information were also considered. While there were a great many similarities among the codes, careful consideration was given to identified differences. The code drafting committee used certain principles as guidance in the resolution of technical differences. The principles were based on the intent to establish provisions consistent with the scope of a residential code that adequately protects public health, safety and welfare; provisions that do not unnecessarily increase construction costs; provisions that do not restrict the use of new materials, products or methods of construction; and provisions that do not give preferential treatment to particular types or classes of materials, products or methods of construction.

Maintenance

The *Massachusetts Building Code for One- and Two-family Dwellings* is kept up to date through the review of proposed changes submitted by code enforcement officials, industry representatives, design professionals and other interested parties.

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780 CMR 51.00

ADMINISTRATION FOR SINGLE- AND TWO-FAMILY DWELLINGS

(Note: 780 CMR 51.00 is unique to Massachusetts)

780 CMR 5101 SCOPE

5101.1 Title. 780 CMR 51.00 through 99.00 (plus Referenced Standards, Regulations, Appendices and Index) shall be known as the Commonwealth of Massachusetts Building Code for One- and Two-Family Dwellings.

5101.2 Scope and Authority. 780 CMR 51.00 through 99.00 is promulgated under authority of M.G.L. c. 143, §§ 93 through 100 in accordance with the legislative intent to establish uniform design and construction regulations throughout the Commonwealth. Municipalities may not modify 780 CMR 51.00 through 99.00 or regulate in the subject areas reserved for the Board of Building Regulations and Standards (hereinafter all referred to as the "BBRS") unless such regulations, ordinances, bylaws or policies are promulgated in accordance with M.G.L. c. 143, §§ 96, 97 and/or 98 as applicable. The provisions of 780 CMR 51.00 through 99.00 shall apply to detached one- and two-family dwellings, not more than three stories in height with separate means of egress, and their accessory structures as follows:

1. The construction, reconstruction, alteration, enlargement, replacement, repair, demolition, removal, or movement and installation of equipment, the inspection of and issuance of and revocation of permits or licenses relative to detached one- and two-family dwellings;
2. The rehabilitation and maintenance of existing buildings;
3. The standards or requirements for materials to be used in connection therewith, including, but not limited to provisions for safety, ingress and egress, energy conservation and sanitary conditions;
4. The establishment of reasonable fees for inspections and the issuance of licenses to individuals engaged as construction supervisors;
5. The certification of inspectors of buildings, building commissioners and local inspectors;
6. The registration of Home Improvement Contractors pursuant to M.G.L. c. 142A, except as such matters are otherwise provided for in the Massachusetts General Laws Annotated, or in the rules and regulations authorized for promulgation under the provisions of 780 CMR 51.00 through 99.00; and
7. Other duties and responsibilities as defined in 780 CMR 110, Special Regulations R1 through R7, as applicable.

5101.3 Application of References. Unless otherwise specifically provided for in 780 CMR 51.00 through 99.00, all references to chapter or section numbers, or to provisions not specifically identified by number, shall be construed to refer to such chapter, section or provision of 780 CMR 51.00 through 99.00.

5101.4 Intent Code Remedial. 780 CMR 51.00 through 99.00 shall be construed to secure its expressed intent, which is to ensure public safety, health and welfare insofar as they are affected by building construction, through structural strength, adequate means of egress facilities, sanitary conditions, light and ventilation, energy conservation and fire safety; and, in general, to secure safety to life and property from all hazards incident to the design, construction, reconstruction, alteration, repair, demolition, removal, movement and/or use or occupancy of detached one- and two-family dwelling buildings, structures or premises.

5101.5 Specialized Codes. In accordance with M.G.L. c. 143, § 96, specialized codes, rules or regulations pertaining to building construction, reconstruction, alteration, repair or demolition, and inspection promulgated by, and under the authority of the various boards which have been authorized by the general court shall be incorporated into 780 CMR 51.00 through 99.00. Areas regulated by the specialized codes shall require that all such work performed is designed, installed and inspected in accordance with the specialized codes. For governing regulations addressing the approval, design, installation and maintenance of fossil-fuel-burning appliances, refer to the *Massachusetts Fuel Gas and Plumbing Codes* (248 CMR) for gas and the *Massachusetts Fire Prevention Regulations State Fire Code* (527 CMR) for oil. Applicable specialized codes, rules or regulations relating to building systems include, but are not limited to, those identified in 780 CMR 5101.5.1 through 5101.5.7 and those listed in 780 CMR 100.

5101.5.1 Electrical. *Massachusetts State Electrical Code* (527 CMR 12.00).

5101.5.2 Gas. *Massachusetts Fuel Gas Code* (248 CMR).

5101.5.3 Mechanical. *International Mechanical Code*.

5101.5.4 Plumbing. *Massachusetts State Plumbing Code*. (248 CMR).

5101.5.5 Property Maintenance. *Massachusetts Sanitary Code (105 CMR).*

5101.5.6 Fire Prevention. *Massachusetts Fire Prevention Regulations (527 CMR).*

5101.5.7 Elevator. *Massachusetts State Elevator Code (524 CMR).*

5101.6 Referenced Standards. The standards referenced in 780 CMR 51.00 through 99.00 and listed in Appendix A shall be considered part of the requirements of 780 CMR 51.00 through 99.00 to the prescribed extent of each such reference. Where differences occur between provisions of 780 CMR 51.00 through 99.00 and referenced standards, the provisions of 780 CMR 51.00 through 99.00 shall apply. The administrative provisions of 780 CMR 51.00 through 99.00 shall apply to all standards referenced in Appendix A, other than the specialized codes listed in 780 CMR 5101.5.

Exception: Where enforcement of a provision of 780 CMR 51.00 through 99.00 would violate the conditions of a listing of a material, equipment or appliance, the conditions of the listing and manufacturer's instructions shall apply.

780 CMR 5102 APPLICABILITY

5102.1 General. The provisions of 780 CMR 51.00 through 99.00 shall apply to all matters affecting or relating to detached one- and two-family dwellings as set forth in 780 CMR 5101 and shall apply with equal force to municipal, county, state authorities of or established by the legislature and private detached one- and two-family dwellings, except where such detached one- and two-family dwellings are otherwise provided for by statute.

5102.2 Matters Not Provided For. Any requirements that are essential for the structural, fire or sanitary safety, or interior climate comfort of an existing or proposed detached one- and two-family dwelling, or for the safety of the occupants thereof, which are not specifically provided for by 780 CMR 51.00 through 99.00, shall be determined by the building official. The BBRS shall be notified by the building official in writing within seven working days of any action taken pursuant to 780 CMR 5102.

5102.3 Zoning Bylaw Restrictions. When the provisions in 780 CMR 51.00 through 99.00 specified for structural strength, adequate egress facilities, sanitary conditions, equipment, light and ventilation, energy conservation or fire safety conflict with the local zoning bylaws or ordinances, 780 CMR 51.00 through 99.00 shall control the construction or alteration of detached one- and two-family dwellings unless such bylaws or ordinances are promulgated in accordance with the provisions of M.G.L. c. 143, § 98.

5102.4 General Bylaw Restrictions. When the provisions herein specified for structural strength,

adequate egress facilities, sanitary conditions, equipment, light and ventilation, energy conservation or fire safety conflict with the local general bylaws or ordinances, 780 CMR 51.00 through 99.00 shall control the construction or alteration of detached one- and two-family dwellings unless such bylaws or ordinances are promulgated in accordance with the provisions of M.G.L. c. 143, § 98.

5102.5 Existing Buildings. Existing detached one- and two-family dwellings shall comply with the provisions of 780 CMR 5102, and all other applicable provisions of 780 CMR 51.00 through 99.00, including all applicable requirements of 780 CMR 93.00. Existing detached one- or two-family dwellings or their accessory buildings, or portions thereof, that have been damaged by fire, flood, impact or have suffered similar physical damage, shall not be reoccupied without approval from the building official.

5102.5.1 General. Unless specifically provided otherwise in 780 CMR 51.00 through 99.00, any detached one- and two-family dwelling shall meet and shall be presumed to meet the provisions of the applicable laws, codes, rules or regulations, bylaws or ordinances in effect at the time such detached one- and two-family dwelling was constructed or substantially altered and shall be allowed to continue to be occupied pursuant to its use and occupancy, provided that the detached one- and two-family dwelling shall be maintained in accordance with 780 CMR 5103.

5102.5.2 In cases which applicable codes, rules or regulations, bylaws or ordinances were not in use at the time of such construction or alteration, the provisions of 780 CMR 5103.0 shall apply.

5102.5.3 In cases where the provisions of 780 CMR 51.00 through 99.00 are less stringent than the applicable codes, rules or regulations, bylaws or ordinances at the time of such construction or substantial alteration, the applicable provisions of 780 CMR 51.00 through 99.00 shall apply, providing such application of these provisions does not result in danger to the public, as determined by the building official.

5102.5.4 Moved Structures. Detached one- and two-family dwellings moved into or within the jurisdiction shall comply with the provisions of 780 CMR 93.00.

780 CMR 5103 MAINTENANCE

5103.1 General. All detached one- and two-family dwellings and all parts thereof, both existing and new, and all systems and equipment therein that are regulated by 780 CMR 51.00 through 99.00 shall be maintained in a safe, operable and sanitary condition. All service equipment, means of egress, devices and safeguards that are required by

780 CMR 51.00 through 99.00, or were required by a previous statute, when erected, altered or repaired, shall be maintained in good working order.

5103.2 Owner Responsibility. The owner, as defined in 780 CMR 52.00, shall be responsible for compliance with the provisions of 780 CMR 5103.0.

780 CMR 5104 VALIDITY

5104.1 General. The provisions of 780 CMR 51.00 through 99.00 are severable, and if any of its provisions shall be held unconstitutional or otherwise invalid by any court of competent jurisdiction, the decision of such court shall not affect or impair any of the remaining provisions.

780 CMR 5105 OFFICE OF THE INSPECTOR OF BUILDINGS OR BUILDING COMMISSIONER

5105.1 Appointment. The chief administrative officer of each city or town shall employ and designate an inspector of buildings or building commissioner (hereinafter inspector of buildings) as well as such other local inspectors as are reasonably necessary to assist the inspector of buildings to administer and enforce 780 CMR 51.00 through 99.00 and the rules and regulations made under the authority thereof. The inspector of buildings shall report directly to and be solely responsible to the appointing authority.

5105.2 Alternate. The inspector of buildings is authorized to designate an alternate who shall exercise all the powers of the inspector of buildings during the temporary absence, disability or conflict of interest of the inspector of buildings. Said alternate shall be duly qualified and certified pursuant to 780 CMR 5105.3.

5105.3 Qualifications of the Inspector of Buildings. In accordance with the provisions of M.G.L. c. 143, § 3, each inspector of buildings shall have had at least five years of experience in the supervision of building construction or design or, in the alternative, a four-year undergraduate degree in a field related to building construction or design, or any combination of education and experience which would confer equivalent knowledge and ability, as determined by the BBRS. In addition, each inspector of buildings shall have had general knowledge of the accepted requirements for building construction, fire prevention, light, ventilation and safe egress, as well as a general knowledge of other equipment and materials essential for safety, comfort and convenience of the occupants of a building or structure.

Each inspector of buildings shall be certified by the BBRS in accordance with the provisions of Special Regulation 780 CMR 110.R7.

Municipalities may require additional qualifications or experience as are deemed

necessary.

5105.4 Qualifications of the Local Inspector. In accordance with the provisions of M.G.L. c. 143, § 3, each local inspector shall have had at least five years of experience in the supervision of building construction or design or, in the alternative, a two-year associate's degree in a field related to building construction or design, or any combination of education and experience which would confer equivalent knowledge and ability, as determined by the BBRS. In addition, such persons shall have had general knowledge of the accepted requirements for building construction, fire prevention, light, ventilation and safe egress, as well as a general knowledge of other equipment and materials essential for safety, comfort and convenience of the occupants of a building or structure.

Each local inspector shall be certified by the BBRS in accordance with the provisions of Special Regulation 780 CMR 110.R7.

Municipalities may require additional qualifications or experience as are deemed necessary.

5105.5 Reporting Requirements.

5105.5.1 Annual Report by City or Town Clerk. In accordance with the provisions of M.G.L. c. 143, § 3, the clerk of each city or town shall, annually, not later than April 1st, transmit to the BBRS the names and official addresses of each inspector of buildings, building commissioner and local inspector as well as at such other times as required pursuant to Special Regulation 780 CMR 110.R7: *Certification of Inspectors of Buildings, Building Commissioners and Local Inspectors*. Such reports shall be submitted on forms prescribed by the BBRS for said purpose.

5105.5.2 New Appointments. Immediately following an appointment, the clerk of each city or town shall report to the BBRS, the name, title and status of each new employee who is appointed as an inspector of buildings, building commissioner or local inspector. Said report shall be provided on forms as prescribed by the BBRS for said purpose and shall be submitted in attestation under the pains and penalties of perjury that said new employee meets or exceeds the minimum qualifications as defined by M.G.L. c. 143, § 3 and 780 CMR 5105.3 and 5105.4, as applicable.

5105.6 Restriction of Employees. Unless authorized by the municipal appointing authority in accordance with 930 CMR 1.00 through 4.00 (the Commonwealth of Massachusetts Ethics Commission), no full-time or part-time building commissioner, inspector of buildings, or full-time or part-time local inspector as defined in 780 CMR 51.00 through 99.00 shall be engaged in, or directly or indirectly connected with, the furnishing of labor, materials or appliances for the construction, alteration or maintenance of a detached one- or

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two-family dwelling, or the preparation of plans or specifications therefore within the city, town or region for which he or she is appointed, unless he or she is the owner of the detached one- or two-family dwelling; nor shall any officer or employee associated with the building department engage in any work which conflicts with his or her official duties or with the interests of the department.

Note: See M.G.L. c. 143, § 3Z: *Part Time Inspector of Buildings, Building Commissioner, Local Inspector, or Alternate Inspector; Other Employment* (Local Option Law relative to part-time employees).

5105.7 Relief from Personal Liability. Insofar as the law allows, while acting for the municipality, the building official charged with the enforcement of 780 CMR 51.00 through 99.00 shall not be deemed personally liable in the discharge of his or her official duties; all such matters are governed by M.G.L. c. 258.

5105.8 Official Records. An official record shall be kept of all business and activities of the department specified in the provisions of 780 CMR 51.00 through 99.00, including, but not limited to, applications received, permits and certificates issued, inspections performed, fees collected, reports of inspections, and notices and orders issued. Such records shall be retained in the official records as long as the detached one- and two-family dwelling to which they relate remains in existence unless otherwise provided for by law.

In accordance with the provisions of M.G.L. c. 66, § 10(b), all such records shall be open to public inspection at all appropriate times and in accordance with reasonable rules to maintain the integrity and security of such records.

780 CMR 5106 DUTIES AND POWERS OF THE BUILDING OFFICIAL

5106.1 General. The inspector of buildings and local inspector (hereinafter referred to as "building official") shall enforce all of the provisions of 780 CMR 51.00 through 99.00, and any other state statutes, rules and regulations, or ordinances or bylaws which empower the building official. The building official shall act on any question relative to the mode or manner of construction and materials to be used in the construction, reconstruction, alteration, repair, demolition, removal, and/or installation of equipment and the location, use, occupancy and maintenance of all detached one- and two-family dwellings except as otherwise specifically provided for by requirements in 780 CMR 5109.

5106.2 Applications and Permits. The building official shall receive applications and issue permits for the construction, reconstruction, alteration, repair, demolition, removal or change in use or

occupancy of buildings and structures; inspect the premises for which such permits have been issued; and enforce compliance with the provisions of 780 CMR 51.00 through 99.00.

5106.3 Notices and Orders. The building official shall issue all necessary notices, orders or citations to ensure compliance with 780 CMR 51.00 through 99.00.

5106.4 Inspections. The building official shall make such inspections as deemed necessary to ensure compliance with 780 CMR 51.00 through 99.00, or the building official may accept reports of inspection by qualified agencies or individuals subject to the applicable requirements of M.G.L. c. 268A. Reports shall be in writing and be certified by a responsible officer of such agency or by the responsible individual.

5106.5 Report to Assessors. Pursuant to M.G.L. c. 143, § 61, the building official shall give to the assessors of the municipality written notice of the granting of permits for the construction of any buildings or structures, or for the removal or demolition, or for any substantial alteration or addition thereto. Such notice shall be given within seven days after the granting of each permit, and shall state the name of the person to whom the permit was granted and the location of the buildings or structures to be constructed, reconstructed, altered, demolished or removed.

780 CMR 5107 DUTIES AND POWERS OF THE STATE INSPECTOR (M.G.L. c. 143, § 3A)

5107.1 The State Inspector. In every city and town of Massachusetts, 780 CMR 51.00 through 99.00 shall be enforced by the State Inspector of the Department of Public Safety, Division of Inspections, as to any detached one- or two-family dwelling or parts thereof that are owned by the Commonwealth or any departments, commissions, agencies or authorities of the Commonwealth. The state inspector shall have, as it pertains to such detached one- or two-family dwellings all the powers of a building commissioner or inspector of buildings. All detached one- or two-family dwellings owned by any authority established by the legislature and not owned by the Commonwealth shall be regulated in accordance with 780 CMR 5106.

5107.2 Other Responsibilities. The state inspector shall make periodic reviews of all local building inspection practices; provide technical assistance; and advice to the local building officials in the implementation of 780 CMR 51.00 through 99.00; and report in writing his findings to the building officials.

5107.3 Review by the Commissioner of Public Safety. The Commissioner of the Commonwealth of Massachusetts, Department of Public Safety shall establish districts which shall be supervised by a state inspector of the Division of Inspections. The Commissioner may review, on his own initiative, or on the application of any state inspector, any action or refusal or failure of action by any building official, the result of which does not comply with the uniform implementation of 780 CMR 51.00 through 99.00; and may reverse, modify or annul, in whole or in part, such action except with respect to the specialized codes, provided that an order or action of the Commissioner shall not reverse, modify, annul or contravene any order, action, determination, interpretation or any decision by the BBRS or the State Building Code Appeals Board.

5107.4 Reports. The state inspector shall file with the BBRS reports of his periodic reviews and recommendations for improvements of building inspection practices. The format and due dates for these reports shall be determined by the BBRS.

780 CMR 5108 RULES AND REGULATIONS

5108.1 Rule-making Authority. Under authority granted by St. 1984, c. 348, as amended, the BBRS is empowered in the interest of public safety, health and general welfare, to adopt and promulgate rules and regulations, and to interpret and implement the provisions of 780 CMR 51.00 through 99.00 to secure the intent thereof.

5108.2 Amendments and Promulgation of Rules. In accordance with the provisions of M.G.L. c. 143, § 97, any person may propose amendments to 780 CMR 51.00 through 99.00. Public hearings shall be held as specified in said law, and at such other times and places as the BBRS may determine, to consider petitions for such amendments. Amendments adopted by the BBRS shall be binding and have the full force and effect in all cities and towns.

5108.3 Activities Requiring Licenses, Registration or Certification. See Special Regulations 780 CMR 110.R1 through R7, as applicable, for the special regulation relating to such license, registration and/or certification.

5108.3.1 Testing Laboratories. When a testing laboratory, branch laboratory and/or project laboratory is engaged to test concrete and/or concrete materials for use in detached one- and two-family dwellings, said laboratory shall be licensed by the BBRS in accordance with 780 CMR 51.00 through 99.00 and Special Regulation 780 CMR 110.R1: *Concrete Testing Laboratories Licensing*.

5108.3.2 Field Technicians. When a person is engaged in the activities of field testing of

concrete for use in detached one- or two-family dwellings and/or controlled materials, such person shall be licensed by the BBRS in accordance with Special Regulation 780 CMR 110.R2: *Concrete Testing Personnel Licensing*.

5108.3.3 Manufactured Buildings. No individual, organization or firm shall be engaged in the construction of manufactured buildings for use in the Commonwealth of Massachusetts or shall act as a third-party inspection agency (TPLA) or a dealer of said manufactured buildings unless approved to construct same or act in such capacity by the BBRS in accordance with Special Regulation 780 CMR 110.R3: *Manufactured Buildings, Building Components and Mobile Homes*.

5108.3.4 Native Lumber. No individual, organization or firm shall engage in the production of native lumber for use in detached one- or two-family dwellings within the Commonwealth of Massachusetts unless registered by the BBRS in accordance with 780 CMR 51.00 through 99.00 and Special Regulation 780 CMR 110.R4, The Rules and Regulations Controlling the Use of Native Lumber.

5108.3.5 Licensing of Construction Supervisors.

5108.3.5.1 Except for those structures governed by Construction Control as identified in the Commonwealth of Massachusetts Base Building Code (780 CMR 1.00, 780 CMR 116.00), no individual shall be engaged in directly supervising persons engaged in construction, reconstruction, alteration, repair, removal or demolition involving any activity regulated by any provision of 780 CMR 51.00 through 99.00, unless said individual is licensed in accordance with 780 CMR 110.R5: *Construction Supervisors*.

No person shall be engaged in the supervision of the field erection of a manufactured building unless such person is licensed in accordance with Special Regulation 780 CMR 110.R5: *Construction Supervisors*.

Exception: Any homeowner performing work for which a building permit is required shall be exempt from the licensing provisions of 780 CMR 5108.3.5, provided that if a homeowner engages a person(s) for hire to do such work, that such homeowner shall act as supervisor. This exception shall not apply to the field erection of manufactured buildings constructed pursuant to 780 CMR 51.00 through 99.00 and Special Regulation 780 CMR 110.R3. For the purposes of 780 CMR 5108.3.5, a "homeowner" is defined as follows: Person(s) who owns a parcel of land on

which he or she resides or intends to reside, on which there is, or is intended to be, a one- or two-family dwelling, attached or detached structures accessory to such use and/or farm structures. A person who constructs more than one home in a two-year period shall not be considered a homeowner.

Note: Any licensed construction supervisor who contracts to do work for a homeowner shall be responsible for performing said work in accordance with 780 CMR 51.00 through 99.00, Special Regulation 780 CMR 110.R5 and all referenced standards and/or manufacturer's recommendations, whether or not the licensed contractor secured the permit for said work.

5108.3.5.2 Exemptions from Construction Supervisor License Requirement. A construction supervisor's license is not required for:

1. Erection of rooftop solar collectors, the erection of signs, the erection of tents, construction of swimming pools;
2. Projects which are subject to "construction control" (*see* 780 CMR 2.00 for definition of "Construction control");
3. Agricultural buildings which are not open to the public or otherwise made available for public use;
4. Massachusetts-registered engineers and Massachusetts-registered architects (collectively referred to herein as "registered design professionals"), provided such engineers and/or architects comply with the Construction Supervisor oversight requirements set forth in Special Regulation 780 CMR 110.R5 generally and 780 CMR 5116.0, as applicable; and
5. The practice of any trade licensed by agencies of the Commonwealth, provided that any such work is within the scope of said license, including, but not limited to, wiring, plumbing, gas fitting, fire protection systems, pipefitting, HVAC and refrigeration equipment.

5108.3.5.3 Municipal Construction Licensing. No municipality shall be prohibited from requiring a license for those individuals engaged in directly supervising persons engaged in construction, reconstruction, alteration, repair, removal or demolition in those categories of buildings and structures for which the BBRS does not require a license, provided that those municipalities which have established licensing requirements for construction supervisors prior to January 1, 1975, may maintain their existing licensing requirements.

5108.3.6 Registration of Home Improvement Contractors. In accordance with the provisions of M.G.L. c. 142A, no home improvement contractor, or organization or firm shall be involved in the improvement of any existing owner-occupied one- to four-family residential building unless said home improvement contractor has registered with the BBRS in accordance with the rules and regulations for the registration of home improvement contractors as set forth in Special Regulation 780 CMR 110.R6.

5108.3.7 Certification of Inspectors of Buildings, Building Commissioners and Local Inspectors. Except as allowed for conditional appointees, no individual shall perform the duties of municipal inspectors of buildings, building commissioners or local inspectors unless certified by the BBRS as set forth in Special Regulation 780 CMR 110.R7.

5108.4 Enforcement. Whoever violates the provisions of 780 CMR 5108 or any rules and regulations promulgated hereunder, or who falsifies or counterfeits a license, registration or certification issued by the BBRS, or who fraudulently issues or accepts such a license, registration or certification shall be punished as provided in 780 CMR 5118 or shall be subject to any other penalty provided for by law.

780 CMR 5109 APPROVAL

5109.1 Approved Materials and Equipment. All materials, equipment and devices subject to approval by the building official shall be constructed and installed in accordance with such approval.

5109.2 Used Materials and Equipment. Used materials, equipment and devices which meet the minimum requirements of 780 CMR 51.00 through 99.00 for new materials, equipment and devices shall be permitted; however, the building official may require satisfactory proof that such materials, equipment and devices have been reconditioned, tested, and/or placed in good and proper working condition prior to approval.

5109.3 Modifications. Wherever there are practical difficulties involved in carrying out the provisions of 780 CMR 51.00 through 99.00, the building official shall have the authority to grant modifications for individual cases, provided the building official shall first find that special individual reason makes the strict letter of 780 CMR 51.00 through 99.00 impractical and the modification is in compliance with the intent and purpose of 780 CMR 51.00 through 99.00 and that such modification does not lessen health, life, fire safety or structural requirements. The details of actions granting modifications shall be recorded and entered in the files of the building department. A building official may seek assistance from the District State Building Inspector for action under 780 CMR 5109. The

provisions of 780 CMR 5109 shall not apply to the specialized codes.

5109.3.1 Areas Prone to Flooding. The building official shall not grant modifications to any provision related to areas prone to flooding as established by 780 CMR 51.00 through 99.00 without the granting of a variance to such provisions by the BBRS Building Code Appeals Board as defined in 780 CMR 5122.

5109.4 Alternative Materials and Equipment.

5109.4.1 General. The provisions of 780 CMR 51.00 through 99.00 are not intended to limit the appropriate use or installation of materials, appliances, equipment or methods of design or construction not specifically prescribed by 780 CMR 51.00 through 99.00, provided that any such alternative has been approved. Alternative materials, appliances, equipment or methods of design or construction shall be approved when the building official is provided acceptable proof and has determined that said alternative is satisfactory and complies with the intent of the provisions of 780 CMR 51.00 through 99.00, and that said alternative is, for the purpose intended, at least the equivalent of that prescribed in 780 CMR 51.00 through 99.00 in quality, strength, effectiveness, fire resistance, durability and safety. Compliance with specific performance-based provisions of 780 CMR, in lieu of a prescriptive requirement, shall also be permitted as an alternate.

5109.4.2 Evidence Submitted. The building official may require that evidence or proof be submitted to substantiate any claims that may be made regarding the proposed alternate.

5109.4.3 Tests. Determination of acceptance shall be based on design or test methods or other such standards approved by the BBRS. In the alternative, where the BBRS has not provided specific approvals, the building official may accept, as supporting data to assist in this determination, duly authenticated engineering reports, formal reports from nationally acknowledged testing/listing laboratories, reports from other accredited sources. The costs of all tests, reports and investigations required under these provisions shall be borne by the applicant.

5109.4.4 Approval by the Construction Materials Safety Board. The building official may refer such matters to the Construction Materials Safety Board in accordance with 780 CMR 5123 for approval.

780 CMR 5110 APPLICATION FOR PERMIT

5110.1 Permit Application. It shall be unlawful to construct, reconstruct, alter, repair, remove or demolish a detached one-and two-family dwelling; or to install or alter any equipment for which a provision is made or the installation of which is

regulated by 780 CMR 51.00 through 99.00 without first filing a written application with the building official and obtaining the required building permit and all other required permits therefore.

5110.2 Temporary Structures and Uses.

5110.2.1 General. The building official is authorized to issue a permit for temporary structures and temporary uses. Such permits shall be limited as to time of service, but shall not be permitted for more than 180 days. The building official is authorized to grant extensions for demonstrated cause.

5110.2.2 Conformance. Temporary structures and uses shall conform to the structural strength, fire safety, means of egress, light, ventilation and sanitary requirements of 780 CMR 51.00 through 99.00 as necessary to ensure the public health, safety and general welfare.

5110.2.3 Termination of Approval. The building official is authorized to terminate such permit for a temporary structure or use and to order the temporary structure or use to be discontinued.

5110.3 Exemptions. A building permit is not required for the following activities. Such exemption, however, shall not exempt the activity from any review or permit that may be required pursuant to other laws, bylaws, rules and regulations of other jurisdictions (e.g., zoning, conservation, etc.).

1. One-story detached accessory buildings used as tool or storage sheds, playhouses and similar uses, provided the floor area does not exceed 120 square feet (12 m²).
2. Fences six feet (1829 mm) in height or less.
3. Retaining walls that, in the opinion of the building official, are not a threat to the public safety, health or welfare and which retain less than four feet (1220 mm) of unbalanced fill.
4. Ordinary repairs as defined in 780 CMR 52.00: *Repairs, ordinary* shall not include the cutting away of any wall, partition or portion thereof, the removal or cutting of any structural beam, column or other load-bearing support, or the removal or change of any required means of egress, or rearrangement of parts of a structure affecting the egress requirements; nor shall ordinary repairs include addition to, alteration of, replacement or relocation of any standpipe, water supply, mechanical system, fire protection system, energy conservation system or other work affecting public health or general safety.
5. Greenhouses: A building permit or notice to the building official is not required for the construction of greenhouses covered exclusively with plastic film (in accordance with St. 1983, c. 671. This exemption does not apply if the greenhouse is to be used for large assemblies of

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people or uses other than normally expected for this purpose).

6. Painting, papering, tiling, carpeting, countertops and similar finish work.
7. Swings and other playground equipment accessory to a one- or two-family dwelling.
8. Window awnings nine square feet (0.8361 m²) or less in area supported by an exterior wall.

5110.4 Form of Application. Applicants shall submit requests for building permits only on the uniform building permit application form contained in Appendix 780 CMR 120.P or on a form that has been approved by the BBRS for such purpose. The application for a permit shall be accompanied by the required fee as prescribed in 780 CMR 5114.

5110.5 By Whom Application is Made. Application for a permit shall be made by the owner or lessee of the detached one- or two-family dwelling or agent of either. If application is made other than by the owner, the written authorization of the owner shall accompany the application. Such written authorization shall be signed by the owner and shall include a statement of ownership and shall identify the owner's authorized agent, or shall grant permission to the lessee to apply for the permit. The full names and addresses of the owner, lessee, applicant and the responsible officers, if the owner or lessee is a corporate body, shall be stated in the application.

Note: It shall be the responsibility of the registered contractor to obtain all permits necessary for work covered by M.G.L. c. 142A, *Regulation of Home Improvement Contractors*. An owner who secures his or her own permits for such shall be excluded from the guaranty fund provisions as defined in M.G.L. c. 142A. Refer to Special Regulation 780CMR 110.R6 and M.G.L. c. 142A for additional information regarding the Home Improvement Contractor Registration Program.

5110.6 Recognition of Laws, Rules and Regulations. The securing of a building permit by the owner, or the owner's authorized agent, to construct, reconstruct, alter, repair, demolish, remove, install equipment or change the use or occupancy of a detached one- or two-family dwelling shall not be construed to relieve or otherwise limit the duties and responsibilities of the licensed, registered or certified individual or firm under the rules and regulations governing the issuance of such license registration or certification.

5110.7 Construction Documents. The application for a permit shall be accompanied by not less than three sets of construction documents. The building official is permitted to waive or modify the requirements for filing construction documents when the building official determines that the scope of the work is of a minor nature. When the quality of the materials is essential for conformity to 780 CMR

51.00 through 99.00, specific information shall be given to establish such quality, and 780 CMR 51.00 through 99.00 shall not be cited, or the term "legal" or its equivalent used as a substitute for specific information.

When such application for permit includes fire protection systems or portions thereof, the building official shall cause one set of construction documents filed pursuant to 780 CMR 5110.7 to be transmitted simultaneously to the head of the local fire department for his file, review and approval of the fire protection system items specified in 780 CMR 5313 and/or 780 CMR 93.00 as applicable. The head of the local fire department shall within ten working days from the date of receipt by him, approve or disapprove such construction documents. If the head of the local fire department disapproves such construction documents, he or she shall notify the building official (refer to M.G.L. c. 148, § 28A) in writing citing the relevant sections of noncompliance with 780 CMR or the sections of the referenced standards of Appendix A. Upon the request of the head of the local fire department, the building official may grant one or more extensions of time for such review provided, however, that the total review by said head of the local fire department shall not exceed 30 calendar days (the same concurrent 30-day period afforded building department review). If such approval, disapproval or request for extension of time is not received by the building official within said ten working days, the building official may deem the fire protection construction documents implicitly approved by the head of the local fire department.

Construction documents shall be drawn upon suitable material. Electronic media documents are permitted to be submitted when approved by the building official. Construction documents shall be of sufficient clarity to indicate the location, nature and extent of the work proposed and show in detail that the work will conform to the provisions of 780 CMR 51.00 through 99.00 and relevant laws, ordinances, rules and regulations, as determined by the building official.

At a minimum, construction documents shall include the following:

1. Site plan;
2. Foundation plan and details (as necessary);
3. Floor plans (including basement and attic levels, if applicable); floor plans shall include location of all required fire protection systems and heating systems storage areas.
4. Exterior building elevations;
5. Framing plans and/or building section(s) adequately depicting structural systems;
6. Schedules, legends and/or details adequately depicting doors, windows and related material installations; and
7. Energy conservation information.

ADMINISTRATION FOR SINGLE- AND TWO-FAMILY DWELLINGS

Failure to comply with 780 CMR 5110.7 Items through .7 shall result in denial of the building permit.

5110.7.1 Preparation of Construction Documents. In accordance with M.G.L. c. 112, § 60L and M.G.L. c. 112, §§ 81D through 81T, the design of any structural member, building system or parts thereof not prescriptively provided for in 780 CMR 51.00 through 99.00 may require the services of a registered design professional. A building official may require plans, specifications, calculations and/or details of sufficient clarity to ensure compliance with the relevant requirements of 780 CMR 51.00 through 99.00 and/or relevant laws, ordinances, rules and regulations.

5110.7.2 Information for Construction in Areas Prone to Flooding. Construction documents for detached one- and two-family dwellings to be constructed in flood hazard areas are required to be prepared by a registered architect or registered professional engineer (collectively referred to herein as registered design professionals) and shall include:

1. Delineation of flood hazard areas, floodway boundaries, and flood zones, and the design flood elevation, as appropriate; and
2. The elevation of the proposed lowest floor, including basement; in areas of shallow flooding (AO zones), the height of the proposed lowest floor, including basement, above the highest adjacent grade.

5110.7.3 Design. Plans, computations and specifications involving new construction, alterations, repairs, expansions or additions or change in use or occupancy of any detached one- or two-family dwelling which are prepared by or under the supervision of a Massachusetts-registered architect or Massachusetts-registered professional engineer, as applicable, shall bear his or her original signature and seal. Said signature and seal shall signify that the plans, computations and specifications meet the applicable provisions of 780 CMR 51.00 through 99.00 and all accepted engineering practices. A legally recognized professional performing work as defined by M.G.L. c. 112, § 81R may be exempted from 780 CMR 5110.

5110.7.4 Plot Plan. The construction documents submitted with the application for permit shall be accompanied by a plot plan showing the size and location of new construction and existing structures on the site and distances from lot lines. In the case of demolition, the plot plan shall show construction to be demolished and the location and size of existing structures and construction that are to remain on the site.

5110.8 Amendments to Application. Subject to the limitations of 780 CMR 5110.9, amendments to a plan, application or other records accompanying the

same shall be filed prior to the commencement of the work for which the amendment to the permit is sought or issued. Such amendments shall be deemed part of the original application and shall be submitted in accordance with 780 CMR 5110.1.

5110.9 Time Limitation of Application. An application for a permit for any proposed work shall be deemed to have been abandoned six months after the date of filing, unless such application has been diligently prosecuted or a permit shall have been issued; except that the building official shall grant one or more extensions of time for additional periods not exceeding 90 days each if there is reasonable cause and upon written request by the owner.

780 CMR 5111 PERMITS

5111.1 Action on Application. The building official shall examine or cause to be examined all applications for permits and amendments thereto within 30 days after filing thereof. If the application or the construction documents do not conform to the requirements of 780 CMR 51.00 through 99.00 and all pertinent laws under the building official's jurisdiction, the building official shall reject such application in writing, stating the reasons therefore. If the building official is satisfied that the proposed work conforms to the requirements of 780 CMR 51.00 through 99.00 and all laws and ordinances applicable thereto, the building official shall issue a permit therefore.

5111.2 Zoning. In accordance with the provisions of M.G.L. c. 40A or St. 1956, c. 665 as amended, no permit for the construction, alteration, change of use or moving of any detached one- or two-family dwelling shall be issued if such detached one- or two-family dwelling or use would be in violation of any zoning ordinance or bylaw.

5111.3 Railroad Right-of-way. No permit to build a structure of any kind on land formerly used as a railroad right-of-way or any property appurtenant thereto formerly used by any railroad company in the state shall be issued without first obtaining, after public hearing, the consent in writing to the issuance of such permit from the Secretary of the Executive Office of Transportation and Construction, all in accordance with M.G.L. c. 40, § 54A.

5111.4 Water Supply. No permit shall be issued for the construction of a detached one- or two-family dwelling which would necessitate the use of water therein, unless a supply of water is available therefore, either from a water system operated by a city, town or district, or from a well located on the land where the detached one- or two-family dwelling is to be constructed, or from a water corporation or company, as required by M.G.L. c. 40, § 54.

5111.5 Debris. As a condition of issuing a permit

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for the construction demolition, renovation, rehabilitation or other alteration of a detached one- or two-family dwelling, M.G.L. c. 40, § 54 requires that the debris resulting there from shall be disposed of in a properly licensed solid waste disposal facility as defined by M.G.L. c. 111, § 150A. Signature of the permit applicant, date and number of the building permit to be issued shall be indicated on a form provided by the building department, and attached to the office copy of the building permit retained by the building department. If the debris will not be disposed of as indicated, the holder of the permit shall notify the building official, in writing, as to the location where the debris will be disposed.

5111.6 Workers' Compensation. No permit shall be issued to construct, reconstruct, alter or demolish a detached one- or two-family dwelling until acceptable proof of insurance pursuant to M.G.L. c. 152, § 25C(6) has been provided to the building official.

5111.7 Hazards to Air Navigation. Application for building new structures or adding to existing structures within airport approaches as defined in M.G.L. c. 90, § 35B and any amendments thereto or language substituted therefore, must include a certification by the applicant that:

1. Either a permit from the Massachusetts Aeronautics Commission is not required because the structure is, or will be:
 - (a) In an area subject to airport approach regulations adopted pursuant to M.G.L. c. 90, §§ 40A through 40I; or
 - (b) in an approach to Logan International Airport; or
 - (c) less than 30 feet (9144 mm) above ground level; or
2. A permit from the Massachusetts Aeronautics Commission is required pursuant to M.G.L. c. 90, § 35B and a copy of said permit is enclosed with the application.

Applications for permits to build a new structure or add to an existing structure requiring the filing of a Notice of Proposed Construction or Alteration (FAA Form 7460-1) with the Federal Aviation Administration shall mail a copy of the completed FAA Form 7460-1 to the Massachusetts Aeronautics Commission within three business days after submitting said form to the FAA.

5111.8 Expiration of Permit. Any permit issued shall be deemed abandoned and invalid unless the work authorized by it shall have been commenced within six months after its issuance; however, for cause, and upon written request of the owner, one or more extensions of time, for periods not exceeding six months each, may be granted in writing by the building commissioner or inspector of buildings. Work under such a permit in the opinion of the building commissioner or inspector of buildings

must proceed in good faith continuously to completion so far as is reasonably practicable under the circumstances. It is the sole responsibility of the owner to inform, in writing, the building commissioner or inspector of buildings of any facts which support an extension of time. The building commissioner or inspector of buildings has no obligation under 780 CMR 5111.8 to seek out information which may support an extension of time. The owner may not satisfy this requirement by informing any other municipal and/or state official or department.

For purposes of 780 CMR 5111.8 any permit issued shall not be considered invalid if such abandonment or suspension of work is due to a court order prohibiting such work as authorized by such permit; provided, however, in the opinion of the building commissioner or inspector of buildings, the person so prohibited by such court order, adequately defends such action before the court. Although said permit shall remain valid pending final disposition by the court, no work shall be performed in violation of a valid court order.

5111.9 Previous Approvals. 780 CMR 51.00 through 99.00 shall not require changes in the construction documents, construction or designated use group of a building for which a lawful permit has been heretofore issued or otherwise lawfully authorized, and the construction of which has been actively prosecuted within **180 days after the effective date** of 780 CMR 51.00 through 99.00 and is completed with dispatch.

5111.10 Signature to Permit. The building official's signature shall be attached to every permit; or the building official shall authorize a subordinate to affix such signature thereto.

5111.11 Approved Construction Documents. When the building official has determined that the proposed construction conforms to the provisions of 780 CMR 51.00 through 99.00 and other applicable laws, bylaws, rules and regulations under his or her jurisdiction, the building official shall stamp or endorse in writing the three sets of construction documents "Approved." One set of the approved construction documents shall be retained by the building official, one set shall be forwarded to the head of the local fire department (when applicable/see 780 CMR 5110.7 and 780 CMR 5111.8) for purposes of notification and the other set shall be kept at the construction site, open to inspection of the building official or an authorized representative at all reasonable times.

5111.12 Revocation of Permits. The building official shall revoke a permit or approval issued under the provisions of 780 CMR 51.00 through 99.00 in case of any false statement or misrepresentation of fact in the application or on the plans on which the permit or approval was based.

5111.13 Approval in Part. The building official may issue a permit for the construction of foundations or any other part of a detached one- or two-family dwelling before the construction documents for the whole detached one- or two-family dwelling have been submitted, provided that adequate information and detailed statements have been filed complying with all of the pertinent requirements of 780 CMR 51.00 through 99.00. Work shall be limited to that work approved by the partial approval and further work shall proceed only when the building permit is amended in accordance with 780 CMR 5110.8. The holder of such permit for the foundation or other parts of a detached one- or two-family dwelling shall proceed at the holder's own risk with the building operation and without assurance that a permit for the entire detached one- or two-family dwelling will be granted.

5111.14 Posting of Permit. A true copy of the building permit shall be kept on the site of operations, open to public inspection during the entire time of prosecution of the work and until the completion of the same.

5111.15 Notice of Start. At least 24-hour notice of start of work under a building permit shall be given to the building official.

780 CMR 5112 DEMOLITION OR REMOVAL OF STRUCTURES

5112.1 Service Connections. Before a detached one- or two-family dwelling is demolished or removed, the owner or agent shall notify all utilities having service connections within the structure such as water, electric, gas, sewer and other connections. A permit to demolish or remove a detached one- or two-family dwelling shall not be issued until a release is obtained from the utilities, stating that their respective service connections and appurtenant equipment, such as meters and regulators, have been removed or sealed and plugged in a safe manner.

All debris shall be disposed of in accordance with 780 CMR 5111.5.

5112.2 Notice to Adjoining Owners. Only when written notice has been given by the applicant to the owners of adjoining lots and to the owners of wired or other facilities, of which the temporary removal is necessitated by the proposed work, shall a permit be granted for the removal of a detached one- or two-family dwelling.

5112.3 Lot Regulation. Whenever a detached one- or two-family dwelling is demolished or removed, the premises shall be maintained free from all unsafe or hazardous conditions by the proper regulation of the lot, restoration of established grades and the erection of the necessary retaining walls and fences in accordance with the provisions of 780 CMR 51.00 through 99.00.

780 CMR 5113 CONDITIONS OF PERMIT

5113.1 Payment of Fees. A permit shall not be issued until the fees prescribed in 780 CMR 5114.0 have been paid.

5113.2 Compliance with Code. The permit shall be a license to proceed with the work and shall not be construed as authority to violate, cancel or set aside any of the provisions of 780 CMR 51.00 through 99.00 or any other law or regulation, except as specifically stipulated by modification or legally granted variation as described in the application. Permits presuming to give authority to violate or cancel the provisions of 780 CMR 51.00 through 99.00 or other ordinances of the jurisdiction shall not be valid. The issuance of a permit based on construction documents and other data shall not prevent the building official from requiring the correction of errors in the construction documents and other data. The building official is also authorized to prevent occupancy or use of a structure where in violation of 780 CMR 51.00 through 99.00 or of any other ordinances of this jurisdiction.

5113.3 Compliance with Permit. All work shall conform to the approved application and the approved construction documents for which the permit has been issued and to any approved amendments to the approved application or the approved construction documents.

5113.4 Compliance with Site Plan. All new work shall be located strictly in accordance with the approved site plan.

780 CMR 5114 FEES

5114.1 General. A permit to begin work for new construction, alteration, removal, demolition or other building operation shall not be issued until the fees prescribed in 780 CMR 5114 shall have been paid to the department of building inspection or other authorized agency of the jurisdiction, nor shall an amendment to a permit necessitating an additional fee be approved until the additional fee has been paid.

5114.2 Special Fees. The payment of the fee for the construction, alteration, removal or demolition for all work done in connection with or concurrently with the work contemplated by a building permit shall not relieve the applicant or holder of the permit from the payment of other fees that are prescribed by law or ordinance for water taps, sewer connections, electrical permits, erection of signs and display structures, or other appurtenant structures, or fees of inspections, certificates of occupancy or other privileges or requirements, both within and without the jurisdiction of the department of building inspection.

5114.3 New Construction and Alterations. The fees for plan examination, building permit and

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inspections shall be as prescribed in 780 CMR 5114.3.1.

5114.3.1 Fee Schedule. A fee for each plan examination, building permit and inspection shall be paid in accordance with the fee schedule as established by the municipality.

5114.4 Related Fees. The payment of the fee for the construction, alteration, removal or demolition for work done in connection with or concurrently with the work authorized by a building permit shall not relieve the applicant or holder of the permit from the payment of other fees that are prescribed by law.

5114.5 Accounting. The building official shall keep an accurate account of all fees collected; and such collected fees shall be deposited in the jurisdiction treasury in accordance with procedures established by the municipality, or otherwise disposed of as required by law.

780 CMR 5115 INSPECTION

5115.1 Preliminary Inspection. Before issuing a permit, the building official shall, if deemed necessary, examine or cause to be examined all detached one- or two-family dwellings and sites for which an application has been filed for a permit to construct, enlarge, alter, repair, remove, demolish or change the use or occupancy thereof.

5115.2 Required Inspections. After issuing a building permit, the building official shall conduct inspections during construction at intervals sufficient to ensure compliance with the provisions of 780 CMR 51.00 through 99.00. The building official shall inform the applicant of the required points of inspection at the time of application. Upon completion of the work for which a permit has been issued, the building official shall conduct a final inspection pursuant to 780 CMR 5115.4. A record of all such examinations and inspections and of all violations of 780 CMR 51.00 through 99.00 shall be maintained by the building official.

In conjunction with specific construction projects, the building official may designate specific inspection points in the course of construction that require the contractor or builder to give the building official 24 hours notice prior to the time when those inspections need to be performed. The building official shall make the inspections within 48 hours after notification. The building official may require the owner, owner's representative or licensed construction supervisor to be present during such inspections.

5115.3 Approved Inspection Agencies. The building official may accept independent third-party reports of approved inspection agencies, provided such agencies satisfy the requirements as to qualifications and reliability and subject to any and all applicable requirements of M.G.L. c. 268A

(Conduct of Public Officials and Employees).

5115.4 Final Inspection. Upon completion of the permitted work of the detached one- or two-family dwelling, or before issuance of the certificate of occupancy required by 780 CMR 5120.0, a final inspection shall be made. All variations of the approved construction documents and permit shall be noted and the holder of the permit shall be notified of the discrepancies.

5115.5 Right of Entry. In the discharge of his duties, the building official shall have the authority to enter at any reasonable hour any detached one- or two-family dwelling in the municipality to enforce the provisions of 780 CMR 51.00 through 99.00.

If any owner, occupant or other person refuses, impedes, inhibits, interferes with, restricts or obstructs entry and free access to every part of the detached one- or two-family dwelling where inspection authorized by 780 CMR 51.00 through 99.00 is sought, the building official, or state inspector, may seek, in a court of competent jurisdiction, a search warrant so as to apprise the owner, occupant or other person concerning the nature of the inspection and justification for it and may seek the assistance of police authorities in presenting said warrant.

5115.6 Approval Required. Work shall not be done beyond the point indicated in each successive inspection without first obtaining the approval of the building official. The building official, upon notification, shall make the requested inspections and shall either indicate the portion of the construction that is satisfactory as completed, or shall notify the permit holder or an agent of the permit holder wherein the same fails to comply with 780 CMR 51.00 through 99.00. Any portions that do not comply shall be corrected and such portion shall not be covered or concealed until authorized by the building official.

5115.7 Identification. The building official shall carry proper identification when inspecting detached one- or two-family dwellings in the performance of duties under 780 CMR 51.00 through 99.00.

5115.8 Jurisdictional Cooperation. The assistance and cooperation of police, fire and health departments and all other officials shall be available to the building official as required in the performance of his duties.

5115.9 Coordination of Inspections. Whenever in the enforcement of 780 CMR 51.00 through 99.00 or another code or ordinance, the responsibility of more than one building official of the jurisdiction is involved, it shall be the duty of the building officials involved to coordinate their inspections and administrative orders as fully as practicable so that the owners and occupants of the detached one- or

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two-family dwelling shall not be subjected to visits by numerous inspectors or multiple or conflicting orders. Whenever an inspector from any agency or department observes an apparent or actual violation of some provision of some law, ordinance or code not within the inspector's authority to enforce, the inspector shall report the findings to the building official having jurisdiction.

780 CMR 5116 LICENSED CONSTRUCTION SUPERVISOR SERVICES DURING CONSTRUCTION

5116.1 General. In accordance with 780 CMR 5108.3.5 and Special Regulation 780 CMR 110.R5, the construction, reconstruction, alteration, repair, removal or demolition of all detached one- and two-family dwellings or the field erection of any manufactured building shall be under the control of a licensed construction supervisor. Except for work under the control of a licensed tradesperson subject to other codes and/or regulations, the licensed construction supervisor shall be responsible for ensuring that all construction-related activities are performed in compliance with 780 CMR 51.00 through 99.00 and the approved construction documents, and all manufacturers' recommendations, as applicable.

At a minimum, the license holder, or responsible registered design professional if so employed to perform construction services, as identified on the building permit application or his or her licensed designee, shall be present at some point on the building site to approve construction, reconstruction, alterations, removal or demolition involving the following work:

1. Foundation:
 - (a) Location of and excavation of foundation;
 - (b) Preparation of bearing material;
 - (c) Placement of forms and reinforcing materials (if applicable);
 - (d) Incorporation of vapor retarders (energy conservation)
 - (e) Placing of concrete (or setting of other foundation materials);
 - (f) Setting weather protection methods (if required);
 - (g) Installation of waterproofing and/or damp proofing materials; and
 - (h) Placement of backfill.

Note: If encountered in excavating for foundation placement, the licensed construction supervisor (or registered design professional) shall report the presence of groundwater to the building official and shall submit a report detailing methods of remediation.

2. Structural frame:
 - (a) Installation of joists, trusses and other structural members and sheathing materials to verify size, species and grade, spacing and

attachment/fastening methods (the licensed construction supervisor shall ensure that any cutting or notching of structural members is performed in accordance with requirements of 780 CMR 51.00 through 99.00);

- (b) Setting of masonry or other structural systems (if used).

3. Energy conservation: Installation of insulation materials, vapor and air infiltration barriers.

4. Fire protection: Installation of smoke and heat detectors and/or systems.

5. Special construction (including, but not limited to):

- (a) Chimneys;
- (b) Retaining walls over four feet (1219 mm) in height above grade.

The building official may require the license holder or his or her licensed designee (or registered design professional) to be present on the building site at other points during the construction, reconstruction, alterations, removal or demolition work as he or she deems appropriate.

Exception: Any homeowner performing work for which a building permit is required shall be exempt from the licensing provisions of 780 CMR 5108.3.5, provided that if a homeowner engages a person(s) for hire to do such work, that such homeowner shall act as supervisor and shall be subject to all applicable provisions of 780 CMR 5116. This exception shall not apply to the field erection of manufactured buildings constructed pursuant to 780 CMR 51.00 through 99.00 and Special Regulation 780 CMR 110.R3 (see definition of "Homeowner" in 780 CMR 5108.3.5.1).

Note: Registered design professionals who secure building permits for and/or perform construction services for detached one- and two-family dwellings are not required to be licensed pursuant to 780 CMR 5108.3.5, provided that said registered design professional secures such permit and performs such services under the responsibilities of his or her professional registration.

When required by the building official, at the completion of the work, prior to the issuance of a certificate of occupancy, the licensed construction supervisor, registered professional or homeowner, as applicable, shall submit a copy of the completed checklist contained in Appendix 780 CMR 120.P to the building official in verification that, to the best of his or her knowledge, the work has been executed in accordance with the provisions of 780 CMR 51.00 through 99.00.

780 CMR 5117 WORKMANSHIP

5117.1 General. All work shall be conducted, installed and completed in a workmanlike and

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acceptable manner, and in accordance with manufacturer recommendations, so as to secure the results intended by 780 CMR 51.00 through 99.00.

780 CMR 5118 VIOLATIONS

5118.1 Unlawful Acts. It shall be unlawful for any person, firm or corporation to use, occupy or change the use or occupancy of any detached one- and two-family dwelling or to erect, construct, alter, extend, repair, remove or demolish any detached one- and two-family dwelling or any equipment regulated by 780 CMR 51.00 through 99.00, or cause same to be done, in conflict with or in violation of any of the provisions of 780 CMR 51.00 through 99.00.

5118.2 Notice of Violation. The building official shall serve a notice of violation or order on the person responsible for the erection, construction, alteration, extension, repair, removal, demolition or occupancy of a detached one- and two-family dwelling in violation of the provisions of 780 CMR 51.00 through 99.00, or in violation of a detail statement or a plan approved there under, or in violation of a permit or certificate issued under the provisions of 780 CMR 51.00 through 99.00. Such order shall be in writing and shall direct the discontinuance of the illegal action or condition and the abatement of the violation.

5118.3 Prosecution of Violation. If the notice of violation is not complied with in the time period specified in said notice of violation, the building official may institute the appropriate proceedings at law or in equity to restrain, correct or abate such violation or to require the removal or termination of the unlawful occupancy of the detached one- and two-family dwelling in violation of the provisions of detached one- and two-family dwellings or of the order or direction made pursuant thereto.

5118.4 Violation Penalties. Whoever violates any provision of 780 CMR 51.00 through 99.00, except any specialized code referenced herein, shall be punishable by a fine of not more than \$1,000 or by imprisonment for not more than one year, or both, for each such violation. Each day during which a violation exists shall constitute a separate offense. The building official shall not begin criminal prosecution for such violations until the lapse of 30 days after the issuance of the written notice of violation.

5118.5 Abatement of Violation. The imposition of the penalties herein prescribed shall not preclude the legal officer of the jurisdiction from instituting appropriate action to prevent unlawful construction or to restrain, correct or abate a violation, or to prevent illegal occupancy of a detached one- and two-family dwelling or to stop an illegal act, conduct, business or occupancy of a detached one- and two-family dwelling on or about any premises.

5118.6 Notice or Orders, Service and Content.

Every notice or order authorized by 780 CMR, except for notices required by 780 CMR 110.R5 and 780 CMR 110.R6, shall be in writing and shall be served on the person responsible:

1. Personally, by any person authorized by the building official; or
2. By any person authorized to serve civil process by leaving a copy of the order or notice at the responsible party's last and usual place of abode; or
3. By sending the party responsible a copy of the order by registered or certified mail return receipt requested, if he or she is within the Commonwealth; or
4. If the responsible party's last and usual place of abode is unknown, by posting a copy of this order or notice in a conspicuous place on or about the premises in violation and by publishing it for at least three out of five consecutive days in one or more newspapers of general circulation wherein the building or premises affected is situated.

780 CMR 5119 STOP WORK ORDER

5119.1 Notice to Owner. Upon notice from the building official that work on any detached one- and two-family dwelling is being prosecuted contrary to the provisions of 780 CMR 51.00 through 99.00, in an unsafe and dangerous manner or contrary to the approved construction documents submitted in support of the building permit application, such work shall be immediately stopped. The stop work order shall be in writing and shall be given to the owner of the property involved, or to the owner's agent, or to the person doing the work, and shall state the conditions under which work will be permitted to resume.

5119.2 Unlawful Continuance. Any person who shall continue any work in or about the detached one- and two-family dwelling after having been served with a stop work order, except such work as that person is directed to perform to remove a violation or unsafe condition, shall be liable to a fine of not more than \$1,000 or by imprisonment for not more than one year, or both, for each such violation. Each day during which a violation exists shall constitute a separate offense.

780 CMR 5120 CERTIFICATE OF OCCUPANCY

5120.1 General. New buildings and structures. A detached one- and two-family dwelling hereafter shall not be used or occupied in whole or in part until the certificate of use and occupancy shall have been issued by the building commissioner or inspector of buildings or, when applicable, the state inspector. The certificate shall not be issued until all the work has been completed in accordance with the

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provisions of the approved permits and of the applicable codes for which a permit is required, except as provided in 780 CMR 5120.3.

5120.2 Buildings or Structures Hereafter Altered.

A detached one- and two-family dwelling, in whole or in part altered, including a change of use shall not be occupied or used until a certificate of approval shall have been issued certifying that the work has been completed in accordance with the provisions of the approved permits and of the applicable codes for which a permit is required. Any use or occupancy, which was not discontinued during the work of alteration, shall be discontinued within 30 days after the completion of the alteration unless the required certificate is issued.

5120.3 Temporary Occupancy. Upon the request of the holder of a permit, a temporary certificate of occupancy may be issued before the completion of the entire work covered by the permit, provided that such portion or portions may be occupied safely prior to full completion of the detached one- and two-family dwelling without endangering life or public welfare. Any occupancy permitted to continue during the work shall be discontinued within 30 days after completion of the work unless a certificate of occupancy is issued by the building official.

5120.4 Contents of Certificate. When a detached one- and two-family dwelling is entitled thereto, the building official shall issue a certificate of occupancy within ten days after written application. Upon completion of the final inspection in accordance with 780 CMR 5115.4 and correction of the violations and discrepancies, the certificate of occupancy shall be issued. The certificate of occupancy shall specify, but shall not be limited to, the following.

1. The edition of the code under which the permit was issued.
2. The permit number.
3. The address of the structure.
4. The name and address of the owner.
5. The use group and occupancy, in accordance with the provisions of 780 CMR 51.00 through 99.00.
6. The type of construction.
7. The name of the building official.
8. If an automatic sprinkler system is provided.
9. Any special stipulations and conditions of the building permit.

780 CMR 5121 UNSAFE STRUCTURES

5121.1 General. The provisions of 780 CMR 5121 are established by M.G.L. c. 143, §§ 6, 7, 8, 9 and 10.

5121.2 Inspection. The building official immediately upon being informed by report or otherwise that a detached one- and two-family

dwelling or anything attached thereto or connected therewith is dangerous to life or limb or that any detached one- and two-family dwelling in that city or town is unused, uninhabited or abandoned, and open to the weather, shall inspect the same; and he shall forthwith in writing notify the owner to remove it or make it safe if it appears to him to be dangerous, or to make it secure if it is unused, uninhabited or abandoned and open to the weather. If it appears that such detached one- and two-family dwelling would be especially unsafe in case of fire, it shall be deemed dangerous within the meaning hereof, and the building official may affix in a conspicuous place upon its exterior walls a notice of its dangerous condition, which shall not be removed or defaced without authority from him.

5121.3 Removal or Making Structure Safe. Any person so notified shall be allowed until 12:00 P.M. of the day following the service of the notice in which to begin to remove such detached one- and two-family dwelling or make it safe, or to make it secure, and he or she shall employ sufficient labor speedily to make it safe or remove it or to make it secure; but if the public safety so requires and if the mayor or selectmen so order, the building official may immediately enter upon the premises with the necessary workmen and assistants and cause such unsafe structure to be made safe or demolished without delay and a proper fence put up for the protection of passersby, or to be made secure.

5121.4 Failure to Remove or Make Structure Safe, Survey Board, Survey Report. If an owner of such unsafe detached one- and two-family dwelling refuses or neglects to comply with the requirements of such notice within the specified time limit, and such detached one- and two-family dwelling is not made safe or taken down as ordered therein, a careful survey of the premises shall be made by a board consisting: in a city, of a city engineer, the head of the fire department, as such term is defined in M.G.L. c. 148, § 1, and one disinterested person to be appointed by the building official; and, in a town, of a surveyor, the head of the fire department and one disinterested person to be appointed by the building official. In the absence of any of the above officers or individuals, the mayor or selectmen shall designate one or more officers or other suitable persons in place of the officers so named as members of said board. A written report of such survey shall be made, and a copy thereof served on such owner.

5121.5 Removal of Dangerous or Abandoned Structures. If such a survey report as outlined in 780 CMR 5121.4 declares such detached one- and two-family dwelling to be dangerous or to be unused, uninhabited or abandoned, and open to the weather, and if the owner continues such refusal or neglect, the building official shall cause it to be

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made safe or taken down or to be made secure; and, if the public safety so requires, said building official may at once enter the detached one- and two-family dwelling, the land on which it stands or the abutting land or buildings, with such assistance as he may require, and secure the same; and may remove and evict, under the pertinent provisions of M.G.L. c. 239, or otherwise, any tenant or occupant thereof; and may erect such protection for the public by proper fence or otherwise as may be necessary, and for this purpose may close a public highway. In the case of such demolition, the said building official shall cause such lot to be leveled to conform with adjacent grades by an inorganic fill. The costs and charges incurred shall constitute a lien upon the land on which the detached one- and two-family dwelling is located, and shall be enforced in an action of contract; and such owner shall, for every day's continuance of such refusal or neglect after being so notified, be punished by a fine in accordance with 780 CMR 5118.4. The provisions of M.G.L. c. 139, § 3A, paragraph two, relative to liens for such debt and the collection of claims for such debt shall apply to any debt referred to in 780 CMR 5121, except that the said building official shall act hereunder in place of the mayor or board of selectmen. During the time such order is in effect, it shall be unlawful to use or occupy such detached one- and two-family dwelling or any portion thereof for any purpose.

5121.6 Remedy of Person Ordered to Remove a Dangerous Structure or Make it Safe.

Notwithstanding the provisions of 780 CMR 5122, an owner, aggrieved by such order, may have the remedy prescribed by M.G.L. c. 139, § 2, provided that any provision of M.G.L. c. 139, § 2 shall not be construed so as to hinder, delay or prevent the building official from acting and proceeding under 780 CMR 5121; and provided, further, that 780 CMR 5121 shall not prevent the city or town from recovering the forfeiture provided in said 780 CMR 5121.5 from the date of the service of the original notice, unless the order is annulled by the jury.

5121.7 Standards for Making Buildings Safe or Secure. Any owner of a detached one- and two-family dwelling who has been notified that said detached one- and two-family dwelling shall be made safe or secure under 780 CMR 5121.2, shall:

1. Remove all materials determined by the head of the fire department or building official to be dangerous in case of fire.
2. Secure all floors accessible from grade utilizing one of the following methods so long as such method is approved by the head of the fire department or building official in writing:
 - (a) Secure all window and door openings in accordance with the U.S. Fire Administration, National Arson Prevention Initiative Board-Up Procedures, continuously until such time as the

building is reoccupied; or

(b) Provide 24-hour watchman services continuously until such time as the building is reoccupied; or

(c) Provide a monitored intruder alarm system at the perimeter of all floors accessible from grade continuously until such time as the building is reoccupied.

Said owner, as the case may be, shall notify the building official that the approved method chosen to secure the building has been incorporated. Said owner shall allow the building official to enter the building for an inspection to ascertain that the building is secured and made safe. Said owner shall allow the head of the fire department to enter the building. The building official shall be supplied with records of maintenance and operation if the provisions of 780 CMR 5121.7. 2(b) or (c) are used.

3. Maintain any existing fire alarms or sprinkler systems unless written permission is obtained from the head of the fire department in accordance with M.G.L. c. 148, § 27A to shut off or disconnect said alarms or systems.

4. Maintain utilities unless written permission is obtained from the building official to disconnect said utilities. Permission to disconnect utilities shall not be granted if it will result in inadequate heat to prevent freezing of an automatic sprinkler system or inadequate utilities to maintain any other protection systems.

5. The requirements of 780 CMR 5121.7 (1-4) do not prevent a building official from ordering or taking expeditious, temporary security measures in emergency situations pending the completion of the requirements of 780 CMR 5121.7 (1-4).

For purposes of 780 CMR 5121.7.5, an "emergency situation" shall be defined as: an unexpected incident, which by its very nature may present a threat to public safety personnel who may be required to affect a rescue effort or conduct fire-extinguishment operations.

Upon refusal or neglect of said owner to comply with such notice, any building official acting under the authority of 780 CMR 5121.3 or 5121.5 shall cause to be secured all window and door openings accessible from grade in accordance with the U.S. Fire Administration, National Arson Prevention Initiative Board-Up Procedures or other equivalent procedure approved by the head of the fire department continuously until such time as the building is reoccupied.

Any building that has been made to conform to the provisions of this regulation during vacancy may be reoccupied under its last permitted use and occupancy classification, provided that any systems which were disconnected or shut down during the period of vacancy are restored to a fully functional condition and subject to 780 CMR 5111.2 and

M.G.L. c. 40A. The local building official shall be notified in writing prior to reoccupancy. If said building is changed in use or occupancy or otherwise renovated or altered it shall be subject to the applicable provisions of 780 CMR 51.00 through 99.00.

5121.8 Marking or Identifying Certain Buildings that are Especially Unsafe in the Case of Fire. Any building official who determines that a building is especially unsafe in case of fire under 780 CMR 5121.2 shall notify the head of the fire department about the existence of said building. The building official, in cooperation with the head of the fire department, shall cause said building to be marked in accordance with the marking requirements established by the Board of Fire Prevention Regulations in 527 CMR 10.00.

780 CMR 5122 BOARD OF APPEALS

5122.1 State Building Code Appeals Board. Whoever is aggrieved by an interpretation, order, requirement, direction or failure to act under 780 CMR 51.00 through 99.00, excluding the specialized codes, by any agency or official of the city, town or region, or agency or official of the state charged with the administration or enforcement of 780 CMR 51.00 through 99.00 or any of its rules or regulations, excepting any specialized codes, may appeal directly to the State Building Code Appeals Board as provided in 780 CMR 5122.

Whoever is aggrieved by an interpretation, order, requirement, direction or failure to act under 780 CMR 51.00 through 99.00 by any agency or official of a city, town or region charged with the administration or enforcement of 780 CMR 51.00 through 99.00, excepting any specialized codes, may appeal directly to the State Building Code Appeals Board or may appeal first to a local or regional building code appeals board and, if aggrieved thereby, he or she may then appeal to the State Building Code Appeals Board as provided in 780 CMR 5122.

Whoever is aggrieved by the head of the fire department's interpretation, order, requirement, direction or failure to act under the applicable provisions of M.G.L. c. 148, § 26A or 26B, may within 45 days after the service of notice thereof, appeal from such interpretation, order, requirement, direction or failure to act, to the Board of Building Regulations and Standards Board of Appeals as provided in 780 CMR 1.00, 780 CMR 5122 and in accordance with M.G.L. c. 143, § 100.

In the event an appeal is taken directly to the State Building Code Appeals Board from an interpretation, order, requirement or direction, said appeal shall be filed as specified in 780 CMR 5122.3.1 with the State Building Code Appeals Board not later than 45 days after the service of notice thereof of the interpretation, order, requirement or direction.

In the event the appeal is taken directly to the State Building Code Appeals Board for the failure to act, the appeal shall be taken not later than 45 days after a request to act has been made by the aggrieved person in writing and served upon the appropriate building official or chief administrative officer of the state or local agency which fails to act.

If the aggrieved person elects to appeal before the local or regional building code appeals board, he shall not be allowed to enter such appeal with the State Building Code Appeals Board until such time as the said local or regional board renders a decision, unless the reason for appeal to the State Building Code Appeals Board is the failure of the local or regional board to act.

5122.2 Membership.

5122.2.1 Three-member Panel. The State Building Code Appeals Board (hereinafter referred to in 780 CMR 5122 as "the Board") shall consist of the membership of the BBRS. The Chairman of the Board may designate any three-members of the Board to act as a three-member panel to hold any public hearing under 780 CMR 5122 and to hear testimony and take evidence. The Chairman of the Board shall select one of the three members to act as chairman of the said three-member panel. If a three-member panel is so designated, the three member panel shall act as the Appeals Board and render a decision as provided in 780 CMR 5122.0.

5122.2.2 Clerk. The administrator of the BBRS shall designate a clerk to the BBRS. The clerk shall keep a detailed record of all decisions and appeals and a record on file showing the name of each appeal properly indexed and the disposition of the appeal. Said record shall be open to public inspection at all times during normal business hours.

5122.2.3 Quorum. A majority of the Board shall constitute a quorum if the appeal is heard by the entire Board.

5122.3 Appeals procedure for State Building Code Appeals Board.

5122.3.1 Entry. Appeals shall be entered on forms provided by the BBRS and shall be accompanied by an entry fee of \$150 or such other amounts as may be determined by the BBRS from time to time. A copy of the appeals application is made part of 780 CMR 51.00 through 99.00 in Appendix B.

The appeal shall be signed by the appellant or his attorney or agent and shall note the name and address of the person or agency on whose behalf the appeal is taken and the name of the person and address wherein service of notice for the appellant is to be made. The appeal shall also state in detail the interpretation, order, requirement, direction or failure to act which are the grounds of the appeals

as well as the particular section or sections of 780 CMR 51.00 through 99.00 which are involved in the appeal and the reasons for the appellant advances supporting the appeal.

A copy of the appeal shall be served in accordance with 780 CMR 5118.6 by the appellant on the person or state, regional or local agency from whose action or inaction the appeal is taken, on or before entry of the appeal. An affidavit, under oath, that such copy has been served shall be filed with the Board forthwith by the appellant.

5122.3.2 Stay of Proceedings. Entry of an appeal shall stay all proceedings in furtherance of the action or failure to act appealed from, unless the state, regional or local agency or any person charged with the administration or enforcement of 780 CMR 51.00 through 99.00 presents evidence and the Board or a three-member panel or a single member of the Board, appointed by the chairman for said purpose, finds that upon the evidence presented, a stay would involve imminent peril to life or property. In such an event, stay of all proceedings shall be waived or the Board or three-member-panel or single member may order such other action necessary to preserve public safety.

Before waiving the stay or proceedings, the Board or three-member panel or single member of the Board, appointed by the chairman for said purpose, shall hold a hearing and give the appellant and state, regional or local agency or any person claiming that a stay would involve imminent peril to life or property, notice in writing of the hearing not less than 24 hours before said hearing.

5122.3.3 Documents. Upon entry, the clerk shall request in writing from the state, city, regional or town officer in charge of the matter on appeal, a copy of the record and all other papers and documents relative to the appeal to be transmitted forthwith to the Board. Said state, city, regional or town officer shall, upon receipt of the request of the Board, transmit forthwith all of the papers and documents and a copy of the record relating to the matter on appeal.

5122.3.4 Hearings. The Chairman of the Board shall fix a convenient time and place for a public hearing. Said hearings shall be held not later than 30 days after the entry of such appeal, unless such time is extended by agreement with the appellant. Any such party may appear in person or by agent or attorney at such hearing. The chairman or clerk shall give notice of the time and place of said hearing to all parties to the hearing and to anyone else requesting notice in writing at least ten days prior thereto. Failure to hold a public hearing within 30 days shall not affect the validity of the appeal or any decision rendered. The Board or

three-member panel in its hearings conducted under 780 CMR 5122 shall not be bound by strict rules of evidence prevailing in courts of law or equity.

5122.3.5 Conduct of Hearing. Hearings shall be conducted in accordance with the informal/fair-hearing rules as set forth in 801 CMR 1.02.

5122.4 Decisions.

5122.4.1 Votes Required. If the appeal is conducted by a three-member panel, then the concurrence of two of the three members holding the public hearing shall be required. If the appeal is conducted by the entire Board, then a majority vote of those hearing the case shall be required.

5122.4.2 Standard. The Board or a three-member panel may vary the application of any provision of 780 CMR 51.00 through 99.00 in any particular case, may determine the suitability of alternate materials and methods of construction and provide reasonable interpretations of the provisions of 780 CMR 51.00 through 99.00, provided that the Board or a three-member panel finds that the decision to grant a variance shall not conflict with the general objectives set forth M.G.L. c. 143, § 95 or with the general objectives of 780 CMR 51.00 through 99.00.

5122.4.3 Time for Decision. The Board shall issue decisions in a reasonably prompt manner. In general decisions will reverse, affirm or modify in whole or in part the order, interpretation, requirement, direction or failure to act which is the subject matter of the appeal.

Failure to render a decision within 30 days shall not affect the validity of any such decision or appeal.

Notice of and a copy of the decision shall be sent by the clerk to all parties to the appeal and anyone requesting in writing a copy of the decision.

5122.4.4 Contents of Decision. All decisions shall be in writing and state findings of fact, conclusions and reasons for decisions. Every decision shall indicate thereon the vote of each member and shall be signed by each member voting.

5122.4.5 Additional Powers. The Board or a three-member panel may impose in any decision limitations both as to time and use, and a continuation of any use permitted may be conditioned upon compliance with future amendments to 780 CMR 51.00 through 99.00.

5122.5 Enforcement. Upon receipt of the decision of the Board or a three-member panel, the parties to the appeal shall take action forthwith to comply with the decision unless a later time is specified in the

decision.

5122.6 Appeals from State Building Code Appeals Board. Any person aggrieved by a decision of the State Building Code Appeals Board may appeal to a court of law or equity in compliance with M.G.L. c. 30A, § 14.

5122.7 Local and Regional Board of Appeals.

5122.7.1 Local and Regional Board of Appeals.

Whoever is aggrieved by an interpretation, order, requirement, direction or failure to act under 780 CMR 51.00 through 99.00, excluding the specialized codes, by any agency or official of a city, region or town charged with the administration or enforcement of 780 CMR 51.00 through 99.00 or any of its rules and regulations may appeal first to the appeals board in that city, region or town or to the State Building Code Appeals Board as provided in 780 CMR 5122.

In the event an appeal is taken from an interpretation, order, requirement or direction, said appeal shall be filed with the local or regional appeals board not later than 45 days after the service of notice thereof of the interpretation, order, requirement or direction.

In the event the appeal is taken for the failure to act, the appeal shall be taken not later than 45 days after a request to act has been made by the aggrieved person in writing and served to the appropriate building official or chief administrative officer of the city, regional or town agency which fails to act.

5122.7.2 Membership. Any building code board of appeals duly established by ordinance or by law or otherwise in a city, region or town and in existence on January 1, 1975, shall qualify as a local board of appeals under 780 CMR 5122 notwithstanding anything to the contrary contained herein. However, the procedure and rights for appeals for such board of appeals shall be governed by 780 CMR 51.00 through 99.00.

If a city, region or town had not duly established by ordinance or bylaw or otherwise a local or regional building code appeals board prior to January 1, 1975, said city, region or town may establish a local or regional board of appeals, hereinafter referred to as the local board of appeals, consisting of five members appointed by the chief administrative officer of the city, region or town: one member appointed for five years, one for four years, one for three years, one for two years and one to serve for one year; and thereafter each new member to serve for five years or until his successor has been appointed.

5122.7.3 Qualifications of Local Board Members. Each member of a local board of appeals established under 780 CMR 5122.7.2 shall have had at least five years experience in the construction, alteration, repair and maintenance of building and building codes. At least one member

shall be a registered structural official.

5122.7.4 Chairman of Local or Regional Board. The board shall select one of its members to serve as chairman and a detailed record of all proceedings shall be kept on file in the building department.

5122.7.5 Absence of Members. During the absence of a member of a local board of appeals for reason of disability or disqualification, the chief administrative officer of the city, region or town shall designate a substitute who shall meet the qualifications as outlined in 780 CMR 5122.7.3.

5122.7.6 Quorum. A quorum shall be three members.

5122.7.7 Procedures. Entry of appeals shall be governed by 780 CMR 5122.3.1 excepting that a city, region or town may set its own entry fee.

Upon notice of entry appeal, the local building commissioner or inspector of buildings shall transmit a copy of the record and all of the papers and documents to the local board of appeals.

Entry of an appeal shall stay all proceedings in furtherance of the action or failure to act appealed from, unless the building commissioner or inspector of buildings certifies in writing to the local board of appeals that a stay would involve imminent peril to life or property. Notice in writing of such certification by the building commissioner or inspector of buildings shall be given to the appellant at least 24 hours prior to the hearing. In such an event a hearing on such stay shall be given first priority and be the first matter heard by the local board of appeals at its next scheduled meeting. The hearing on the appeal shall be held as soon as possible thereafter in accordance with 780 CMR 5122.7.8.

The local board of appeals may establish its own rules for procedure not established herein or not inconsistent with 780 CMR 51.00 through 99.00 or with the general objectives set forth in M.G.L. c. 143, § 95.

5122.7.8 Hearings. All hearings shall be public and notice of said hearings shall be advertised in a newspaper of general circulation in the city, region or town in which the appeal is taken at least ten days before said hearing. Notice of the hearing, setting forth the date and time of said hearing, shall be mailed by the local board of appeals to all parties and all those who requested notice in writing at least 14 days before said hearing. Said hearings shall be held not later than 30 days after the entry of such appeal, unless such time is extended by agreement with the appellant. 780 CMR 5122.7.8 as it pertains to notice shall not apply to hearings on a stay as provided in 780 CMR 5122.7.7.

5122.7.9 Decisions of Local Boards. A concurring vote of a majority of all of the

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members present shall be required for any decision. The local board of appeals may vary the application of 780 CMR 51.00 through 99.00 to any particular case, may consider the suitability of alternative materials and methods of construction and may provide reasonable interpretations of the provisions of 780 CMR 51.00 through 99.00, provided that the decision of the local board shall not conflict with the general objectives of 780 CMR 51.00 through 99.00 or with the general objectives of M.G.L. c. 143, § 95. The local board of appeals may impose, in any decision; limitations both as to time and use, and a continuation of any use permitted may be conditioned upon compliance with future amendments to 780 CMR 51.00 through 99.00.

5122.7.10 Time for decision. The board shall within 30 days after such hearing, unless such time is extended by agreement of the parties, issue a decision or order reversing, affirming or modifying in whole or in part the order, interpretation, requirement, direction or failure to act which is the subject matter of the appeal.

Failure to render a decision within 30 days shall not affect the validity of any such decision or appeal.

Notice of and a copy of the decision shall be sent by the clerk to all parties to the appeal and to anyone requesting in writing a copy of the decision.

5122.7.11 Contents of Decision. All decisions shall be in writing and state findings of fact, conclusions and reasons for the decisions. Every decision shall indicate thereon the vote of each member and shall be signed by each member voting. Any decision shall not be considered by any person or agency as a precedent for future decisions.

5122.7.12 Copy of Decision. A copy of any decision by a local board of appeals shall be transmitted to the State Building Code Appeals Board within ten days after the rendering of such decision. If the State Building Code Appeals Board disapproves of said decision of the local board, it may on its own motion, appeal the decision of the local board of appeals according to 780 CMR 5122 and call for a hearing *de novo*.

If the State Building Code Appeals Board does not notify the local board in writing within 45 days from the date of the local board's decision, the said decision shall be deemed approved, provided that the decision shall not conflict with the general objectives of the state building code and the objectives of M.G.L. c. 143, § 95.

5122.7.13 Enforcement of Decision. If said decision is approved by the State Building Code Appeals Board, all parties to the appeal shall take immediate action in accordance with the decision of the local board unless the person aggrieved by

such decision appeals to the State Building Code Appeals Board as provided in 780 CMR 5122.

5122.7.14 Review. Any person, including the State Building Code Appeals Board, aggrieved by a decision of the local board of appeals, whether or not a previous party to the decision, or any municipal officer or official board of the municipality, may, not later than 45 days after the mailing of the decision of the local board, apply to the State Building Code Appeals Board for a hearing *de novo* before the State Board, in accordance with the regulations contained in 780 CMR 5122.

780 CMR 5123 CONSTRUCTION MATERIALS SAFETY BOARD

5123.1 Membership. There shall be a board under the control of the BBRS called the Construction Materials Safety Board (CMSB), which shall consist of 11 members, one of whom shall be a member of the BBRS who shall be *ex-officio* and a voting member of the Board and ten members to be appointed by the chairman of the BBRS: one of whom shall be a member of the Board of Fire Prevention Regulations (BFPR) and who shall be *ex-officio* and a voting member of the board; one of whom shall be a municipal building inspector; one of whom shall be a registered professional engineer who is a structural engineer; one of whom shall be a registered architect; one of whom shall be a representative of a commercial testing laboratory; one of whom shall be a representative of a public testing laboratory; two of whom shall be representatives from the construction industry; one of whom shall be a member of a university faculty engaged in research and teaching in structural materials; and one of whom shall be a member of a university faculty engaged in research and teaching in the area of theoretical and applied mechanics.

5123.2 Duties. The CMSB will review applications for registration or licensing of individuals, laboratories or firms responsible for the inspection, control and testing of construction materials, and review applications and pertinent data relevant to all materials, devices, products and methods of construction not included in 780 CMR 51.00 through 99.00 and report to the BBRS their recommendations. The CMSB will collect information and review cases where disciplinary action against an existing license, whether an individual, laboratory or firm, has been proposed; and make recommendations to the BBRS. The BBRS will issue applications, receive payment for the review of such applications and approvals, registration and licensing fees, and maintain records for the efficient dispatch of the duties of the CMSB.

ADMINISTRATION FOR SINGLE- AND TWO-FAMILY DWELLINGS

5123.3 Testing and Evaluation Groups. The BBRS shall establish and maintain testing and evaluation groups that will have the responsibility of administering and directing, under the supervision of the BBRS, the testing and controls for evaluating individual applicants, laboratories and firms wishing to become registered or licensed.

780 CMR 52.00

DEFINITIONS

(Note: Chapter 52 is unique to Massachusetts)

780 CMR 5201 GENERAL

5201.1 Scope. Unless otherwise expressly stated, the following words and terms shall, for the purposes of 780 CMR 51.00 through 99.00, have the meanings indicated in 780 CMR 52.00.

5201.2 Interchangeability. Words used in the present tense include the future; words in the masculine gender include the feminine and neuter; the singular number includes the plural and the plural, the singular.

5201.3 Terms Defined in Other Codes. Where terms are not defined in 780 CMR 51.00 through 99.00 such terms shall have meanings ascribed to them as in other code publications of the International Code Council or Code of Massachusetts Regulations (CMRs).

5201.4 Terms not Defined. Where terms are not defined through the methods authorized by this section, such terms shall have ordinarily accepted meanings such as the context implies.

780 CMR 5202 DEFINITIONS

ACCESSIBLE. Signifies access that requires the removal of an access panel or similar removable obstruction.

ACCESSIBLE, READILY. Signifies access without the necessity for removing a panel or similar obstruction.

ACCESSORY STRUCTURE. In one- and two-family dwellings not more than three stories high with separate means of egress, a building, the use of which is incidental to that of the main building and which is located on the same lot.

[B] ADDITION. An extension or increase in floor area or height of a building or structure.

AIR CIRCULATION, FORCED. A means of providing space conditioning utilizing movement of air through ducts or plenums by mechanical means.

AIR-CONDITIONING SYSTEM. A system that consists of heat exchangers, blowers, filters, supply, exhaust and return-air systems, and shall include any apparatus installed in connection therewith.

[B] ALTERATION. Any construction or renovation to an existing structure other than repair or addition that requires a permit. Also, a change in a mechanical system that involves an extension, addition or change to the arrangement, type or

purpose of the original installation that requires a permit.

(ALTERNATE INSPECTOR. *A person appointed to act in the absence of the inspector of buildings or building commissioner in case of illness, disability or conflicting interest. An alternate inspector shall meet or exceed the minimum qualifications defined by M.G.L. c. 143, § 3 for an inspector of buildings/building commissioner and shall be certified in accordance with Special Regulation 110.R7 (see Appendix A).*

[B] ANCHORS. See "Supports."

ANNUAL FUEL UTILIZATION EFFICIENCY (AFUE). *The ratio of annual output energy to annual input energy, which includes any nonheating season pilot input loss, and for gas or oil-fired furnaces or boilers, does not include electrical energy.*

APPLIANCE. A device or apparatus that is manufactured and designed to utilize energy and for which 780 CMR 51.00 through 99.00 provides specific requirements.

APPROVED. Approved refers to approval by the building official as the result of investigation and tests conducted by him or her, or by reason of accepted principles or tests by nationally recognized organizations.

APPROVED AGENCY. An established and recognized agency regularly engaged in conducting tests or furnishing inspection services, when such agency has been approved by the building official.

ASPECT RATIO. The ratio of the height to width (h/w) of a shear wall. The shear wall height is the maximum clear height from top of foundation or diaphragm to bottom of diaphragm framing above and the shear wall width is the sheathed dimension in the direction of applied force on the shear wall.

ATTIC. The unfinished space between the ceiling joists of the top story and the roof rafters.

BACKFLOW PREVENTER. A device or means to prevent backflow.

BACKFLOW PREVENTER, REDUCED-PRESSURE-ZONE TYPE. A backflow-prevention device consisting of two independently acting check valves, internally force loaded to a normally closed position and separated by an intermediate chamber (or zone) in which there is an automatic relief means of venting to atmosphere

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internally loaded to a normally open position between two tightly closing shutoff valves and with means for testing for tightness of the checks and opening of relief means.

BACKFLOW, WATER DISTRIBUTION. The flow of water or other liquids into the potable water-supply piping from any sources other than its intended source.

[B] BALCONY, EXTERIOR. An exterior floor projecting from and supported by a structure without additional independent supports.

[B] BASEMENT. That portion of a building that is partly or completely below grade (*see* "Story above grade").

BASEMENT WALL. The opaque portion of a wall that encloses one side of a basement and has an average below grade wall area that is 50% or more of the total opaque and non-opaque area of that enclosing side.

BASIC WIND SPEED. Three-second gust speed at 33 feet (10 058 mm) above the ground in Exposure C (*see* 780 CMR 5301.2.1) as given in 780 CMR Figure 5301.2(4).

BOARD OF BUILDING REGULATIONS AND STANDARDS (BBRS). *In accordance with M.G.L. c. 143, § 94, the Board responsible for the development and promulgation of 780 CMR 51.00 through 99.00. See M.G.L. c. 143, § 93 for the Board's makeup and 780 CMR 95.00 through 100.00 for additional responsibilities of the BBRS.*

BOILER. *A closed vessel in which water is heated, steam is generated, steam is superheated, or any combination thereof, by the application of heat from combustible fuels in a self-contained or attached furnace. Note that gas-fired boilers are addressed by 248 CMR and oil-fired boilers are addressed by 527 CMR.*

[B] BOND BEAM. A horizontal grouted element within masonry in which reinforcement is embedded.

[B] BRACED WALL LINE. A series of braced wall panels in a single story constructed in accordance with 780 CMR 5602.10 for wood framing or 780 CMR 5603.7 or 5301.1.1 for cold-formed steel framing to resist racking from seismic and wind forces.

[B] BRACED WALL PANEL. A section of a braced wall line constructed in accordance with 780 CMR R602.10 for wood framing or 780 CMR R603.7 or R301.1.1 for cold-formed steel framing, which extend the full height of the wall

BTU/H. The listed maximum capacity of an appliance, absorption unit or burner expressed in British thermal units input per hour.

BUILDING. *Building shall mean any one- and two-family dwelling or portion thereof that is used, or designed or intended to be used, for human habitation, for living, sleeping, cooking or eating purposes, or any combination thereof, and shall include accessory structures thereto.*

BUILDING CODE ENFORCEMENT OFFICIAL. *The term used to refer collectively to inspectors of buildings, building commissioners and local inspectors. All building code enforcement officials shall meet or exceed the minimum qualifications for the position as defined by M.G.L. c. 143, § 3 and shall be certified in accordance with Special Regulation 780 CMR 110.R7 (*see* 780 CMR 110; also *see* definition for "Building official").*

BUILDING COMMISSIONER. *The administrative chief of the building department in a municipality who is charged with the administration and enforcement of 780 CMR 51.00 through 99.00 (*see* also "Inspector of buildings" and "Building official"). All building commissioners shall meet or exceed the minimum qualifications for the position as defined in M.G.L. c. 143, § 3 and shall be certified in accordance with Special Regulation 780 CMR 110.R7 (*see* 780 CMR 110).*

BUILDING ENVELOPE. *The elements of a building which enclose heated or cooled spaces through which thermal energy is capable of being transferred to or from the exterior or to or from spaces exempted by the provisions of 780 CMR 6101.4.1.*

BUILDING, EXISTING. *An existing building that has been legally occupied for five or more years and is also a building erected prior to the adoption of 780 CMR 51.00 through 99.00, or one for which a legal building permit has been issued.*

BUILDING LINE. The line established by law, beyond which a building shall not extend, except as specifically provided by law.

[B] BUILDING OFFICIAL. The officer or other designated authority charged with the administration and enforcement of 780 CMR 51.00 through 99.00.

BUILDING THERMAL ENVELOPE. *See "Building envelope".*

BUILT-UP ROOF COVERING. Two or more layers of felt cemented together and surfaced with a cap sheet, mineral aggregate, smooth coating or similar surfacing material.

CEILING HEIGHT. The clear vertical distance from the finished floor to the finished ceiling.

CENTRAL STATION, CENTRAL STATION FIREALARM SYSTEM AND CENTRAL STATION SERVICES. *See NFPA 72, as listed in 780 CMR 100.*

CERTIFICATE OF APPROVAL. A written document from the appropriate building official approving an action, type of material, and the like.

CERTIFICATE OF USE AND OCCUPANCY. The certificate issued by the building code enforcement official which permits the use of a building in accordance with the approved plans and specifications and which certifies compliance with provisions of law for the use and occupancy of the building in its several parts, together with any special stipulations or conditions of the building permit.

CERTIFICATION (In reference to building code enforcement officials). See definitions for "Building commissioner", "Inspector of buildings" and "Local inspector." Also see Special Regulation 780 CMR 110.R7.

CERTIFICATION (In reference to manufactured buildings and building components). Any manufactured building or building component that meets the provisions of Special Regulation 780 CMR 110.R3.

CHANGE OF USE. An alteration by change of use in a building heretofore existing to a new use group which imposes other special provisions of law and/or regulation governing building construction, equipment or means of egress

[B] **CHIMNEY.** A primary vertical structure containing one or more flues, for the purpose of carrying gaseous products of combustion and air from a fuel-burning appliance to the outside atmosphere.

CHIMNEY CONNECTOR. A pipe that connects a fuel-burning appliance to a chimney.

[B] **CHIMNEY TYPES.**

Residential-type Appliance. An approved chimney for removing the products of combustion from fuel-burning, residential-type appliances producing combustion gases not in excess of 1,000°F (538°C) under normal operating conditions, but capable of producing combustion gases of 1,400°F (760°C) during intermittent forces firing for periods up to one hour. All temperatures shall be measured at the appliance flue outlet. Residential-type appliance chimneys include masonry and factory-built types.

CLADDING. The exterior materials that cover the surface of the building envelope that is directly loaded by the wind.

CLOSET. A small room or chamber used for storage.

CODE OF MASSACHUSETTS REGULATION (CMR). Regulations that are codified by the Secretary of State, Commonwealth of Massachusetts. 780 CMR 100. lists various CMRs applicable to building construction and/or design.

COEFFICIENT OF PERFORMANCE (COP)—COOLING. The ratio of the rate of heat removal to the rate of energy input, in consistent units, for a complete cooling system or factory-assembled equipment, as tested under a nationally recognized standard or designated operating conditions.

COEFFICIENT OF PERFORMANCE (COP)—HEAT PUMP—HEATING. The ratio of the rate of heat delivered to the rate of energy input, in consistent units, for a complete heat pump system under designated operating conditions. Supplemental heat shall not be considered when checking compliance with the heat pump equipment.

COMBUSTIBLE MATERIAL. Any material not defined as noncombustible.

COMBUSTION AIR. The air provided to fuel-burning equipment including air for fuel combustion, draft hood dilution and ventilation of the equipment enclosure.

CONDENSATE. The liquid that separates from a gas due to a reduction in temperature, e.g., water that condenses from flue gases and water that condenses from air circulating through the cooling coil in air conditioning equipment.

CONDENSING APPLIANCE. An appliance that condenses water generated by the burning of fuels.

CONDITIONED AIR. Air treated to control its temperature, relative humidity or quality.

CONDITIONED AREA. That area within a building provided with heating and/or cooling systems or appliances capable of maintaining, through design or heat loss/gain, 68°F (20°C) during the heating season and/or 80°F (27°C) during the cooling season, or has a fixed opening directly adjacent to a conditioned area.

CONDITIONED FLOOR AREA. The horizontal projection of the floors associated with the conditioned space.

CONDITIONED SPACE. For energy purposes, space within a building that is provided with heating and/or cooling equipment or systems capable of maintaining, through design or heat loss/gain, 50°F (10°C) during the heating season and 85°F (29°C) during the cooling season, or communicates directly with a conditioned space. For mechanical purposes, an area, room or space being heated or cooled by any equipment or appliance.

CONFINED SPACE. A room or space having a volume less than 50 cubic feet per 1,000 Btu/h (4.83 L/W) of the aggregate input rating of all fuel-burning appliances installed in that space.

CONSTRUCTION CONTROL. The compilation of Building Code requirements found in 780 CMR 1, Section 116 or otherwise referenced in 780 CMR and directed toward all buildings and structures requiring registered architectural services or registered professional engineering services in accordance with M.G.L. c. 143, § 54A; M.G.L. c. 112, §§ 60A through 60L; and, M.G.L. c. 112 §§ 81D through 81T.

[B] CONSTRUCTION DOCUMENTS. Written, graphic and pictorial documents prepared or assembled for describing the design, location and physical characteristics of the elements of a project necessary for obtaining a building permit. Construction drawings shall be drawn to an appropriate scale.

CONVECTOR. A system-incorporating heating element in an enclosure in which air enters an opening below the heating element, is heated and leaves the enclosure through an opening located above the heating element.

[B] CORROSION RESISTANCE. The ability of a material to withstand deterioration of its surface or its properties when exposed to its environment.

[B] COURT. A space, open and unobstructed to the sky, located at or above grade level on a lot and bounded on three or more sides by walls or a building.

CRIPPLE WALL. A framed wall extending from the top of the foundation to the underside of the floor framing of the first story above grade plane.

DALLE GLASS. A decorative composite glazing material made of individual pieces of glass that are embedded in a cast matrix of concrete or epoxy.

DAMPER, VOLUME. A device that will restrict, retard or direct the flow of air in any duct, or the products of combustion of heat-producing equipment, vent connector, vent or chimney.

[B] DEAD LOADS. The weight of all materials of construction incorporated into the building, including but not limited to walls, floors, roofs, ceilings, stairways, built-in partitions, finishes, cladding, and other similarly incorporated architectural and structural items, and fixed service equipment.

[B] DECK. An exterior floor system supported on at least two opposing sides by an adjoining structure and/or posts, piers, or other independent supports.

[B] DECORATIVE GLASS. A carved, leaded or Dalle glass or glazing material whose purpose is decorative or artistic, not functional; whose coloring, texture or other design qualities or components cannot be removed without destroying the glazing material; and whose surface, or assembly into which it is incorporated, is divided into segments.

DEGREE DAY, COOLING. A unit, based on temperature difference and time, used in estimating cooling energy consumption and specifying nominal cooling load of a building in summer. For any one day, when the mean temperature is more than 65°F (18°C), there are as many degree days as there are degrees Fahrenheit (Celsius) difference in temperature between the mean temperature for the day and 65°F (18°C). Annual cooling degree days (CDD) are the sum of the degree days over a calendar year.

DEGREE DAY, HEATING. A unit, based on temperature difference and time, used in estimating heating energy consumption and specifying nominal heating load of a building in winter. For any one day, when the mean temperature is less than 65°F (18°C), there are as many degree days as there are degrees Fahrenheit (Celsius) difference in temperature between the mean temperature for the day and 65°F (18°C). Annual heating degree days (HDD) are the sum of the degree days over a calendar year.

DESIGN PROFESSIONAL. See definition of "Registered design professional" in 780 CMR 52.00.

DIAMETER. Unless specifically stated, the term "diameter" is the nominal diameter as designated by the approved material standard.

[B] DIAPHRAGM. A horizontal or nearly horizontal system acting to transmit lateral forces to the vertical resisting elements. When the term "diaphragm" is used, it includes horizontal bracing systems.

DIRECT-VENT APPLIANCE. A system consisting of an appliance, combustion air and flue gas connections between the appliance and the outside atmosphere, and a vent cap supplied by the manufacturer, and constructed so that all air for combustion is obtained from the outside atmosphere and all flue gases are discharged to the outside atmosphere.

DRAFT. The pressure difference existing between the appliance or any component part and the atmosphere, that causes a continuous flow of air and products of combustion through the gas passages of the appliance to the atmosphere.

Induced Draft. The pressure difference created by the action of a fan, blower or ejector, that is located between the appliance and the chimney or vent termination.

Natural draft. The pressure difference created by a vent or chimney because of its height, and the temperature difference between the flue gases and the atmosphere.

DRAFT HOOD. A device built into an appliance, or a part of the vent connector from an appliance, which is designed to provide for the ready escape of

the flue gases from the appliance in the event of no draft, backdraft or stoppage beyond the draft hood; prevent a backdraft from entering the appliance; and neutralize the effect of stack action of the chimney or gas vent on the operation of the appliance.

[B] DRAFT STOP. A material, device or construction installed to restrict the movement of air within open spaces of concealed areas of building components such as crawl spaces, floor-ceiling assemblies, roof-ceiling assemblies and attics.

DUCT SYSTEM. A continuous passageway for the transmission of air which, in addition to ducts, includes duct fittings, dampers, plenums, fans and accessory air-handling equipment and appliances.

DWELLING. Any building that contains one or two dwelling units used, intended, or designed to be built, used, rented, leased, let or hired out to be occupied, or that are occupied for living purposes.

[B] DWELLING UNIT. A single unit providing complete independent living facilities for one or more persons, including permanent provisions for living, sleeping, eating, cooking and sanitation.

EMERGENCY ESCAPE AND RESCUE OPENING. An operable window, door or similar device that provides for a means of escape and access for rescue in the event of an emergency.

ENERGY. *The capacity for doing work taking a number of forms which may be transformed from one into another, such as thermal (heat), mechanical (work), electrical and chemical in customary units, measured in kilowatt-hours (kWh) or British thermal units (Btu) (J) (see "New energy").*

NEW ENERGY. *Energy, other than recovered energy, utilized for the purpose of heating or cooling (see "Energy").*

ENERGY ANALYSIS. *A method for determining the annual (8,760 hours) energy use of the proposed design and standard design based on hour-by-hour estimates of energy use.*

ENERGY EFFICIENCY RATIO (EER). *The ratio of net equipment cooling capacity in Btu/h (W) to total rate of electric input in watts under designated operating conditions. When consistent units are used, this ratio becomes equal to COP (see also "Coefficient of performance").*

EQUIPMENT. All piping, ducts, vents, control devices and other components of systems other than appliances that are permanently installed and integrated to provide control of environmental conditions for buildings. This definition shall also include other systems specifically regulated in 780 CMR 51.00 through 99.00.

EQUIPMENT, EXISTING. *Any equipment regulated by 780 CMR 51.00 through 99.00 which*

was legally installed prior to the effective date of 780 CMR 51.00 through 99.00, or for which a permit to install has been issued.

EXPOSED FLOOR. *Floors that are part of the building envelope and are not enclosed by other building elements (e.g., cantilevers, floors built on pilings). For insulation purposes, these areas are to be treated as ceilings.*

EXTERIOR ENVELOPE. See "Building envelope".

EXTERIOR INSULATION FINISH SYSTEMS (EIFS). Synthetic stucco cladding systems typically consisting of five layers: adhesive, insulation board, base coat into which fiber-glass reinforcing mesh is embedded, and a finish coat in the desired color.

EXTERIOR WALL. An above-grade wall enclosing conditioned space. Includes between floor spandrels, peripheral edges of floors, roof and basement knee walls, dormer walls, gable end walls, walls enclosing a mansard roof, and basement walls with an average below grade wall area that is less than 50% of the total opaque and non-opaque area of that enclosing side.

FACTORY-BUILT CHIMNEY. A listed and labeled chimney composed of factory-made components assembled in the field in accordance with the manufacturer's instructions and the conditions of the listing.

FENESTRATION. Skylights, roof windows, vertical windows (whether fixed or moveable); opaque doors; glazed doors; glass block; and combination opaque/glazed doors.

FIBER CEMENT SIDING. A manufactured, fiber-reinforcing product made with an inorganic hydraulic or calcium silicate binder formed by chemical reaction and reinforced with organic or inorganic non-asbestos fibers, or both. Additives which enhance manufacturing or product performance are permitted. Fiber cement siding products have either smooth or textured faces and are intended for exterior wall and related applications.

FIREBLOCKING. Building materials installed to resist the free passage of flame to other areas of the building through concealed spaces.

[B] FIREPLACE. An assembly consisting of a hearth and fire chamber of noncombustible material and provided with a chimney, for use with solid fuels.

Factory-built Fireplace. A listed and labeled fireplace and chimney system composed of factory-made components, and assembled in the field in accordance with manufacturer's instructions and the conditions of the listing.

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Masonry Chimney. A field-constructed chimney composed of solid masonry units, bricks, stones or concrete.

Masonry Fireplace. A field-constructed fireplace composed of solid masonry units, bricks, stones or concrete.

FIREPLACE STOVE. A free-standing, chimney-connected solid-fuel-burning heater designed to be operated with the fire chamber doors in either the open or closed position.

FIREPLACE THROAT. The opening between the top of the firebox and the smoke chamber.

FIRE SEPARATION DISTANCE. The distance measured from the building face to the closest interior lot line, to the centerline of a street, alley or public way, or to an imaginary line between two buildings on the property. The distance shall be measured at right angles from the lot line.

[B] FLAME SPREAD. The propagation of flame over a surface.

[B] FLAME SPREAD INDEX. The numeric value assigned to a material tested in accordance with ASTM E 84.

FLOOR FURNACE. *A self-contained indirect-fired or electrically heated furnace designed to be suspended from the floor of the space being heated. A fuel-burning floor furnace is designed to take air for combustion from outside the space being heated, and is provided with means for observing flame and lighting the appliance from such space.*

FLUE. See "Vent."

FLUE, APPLIANCE. The passages within an appliance through which combustion products pass from the combustion chamber to the flue collar.

FLUE COLLAR. The portion of a fuel-burning appliance designed for the attachment of a draft hood, vent connector or venting system.

FLUE GASES. Products of combustion plus excess air in appliance flues or heat exchangers.

FOUNDATION. *A base constructed to support any building or structure including, but not limited to, footings, floating foundation, piles and caissons.*

FOUNDATION WALL. *A wall below the floor nearest grade serving as a support for a wall, pier, column or other structural part of a building.*

[B] FOAM PLASTIC INSULATION. A plastic that is intentionally expanded by the use of a foaming agent to produce a reduced-density plastic consisting open or closed cells distributed throughout the plastic and that has a density less than 20 pounds per cubic foot (320 kg/m³).

FURNACE. *A vented heating appliance designed or arranged to discharge heated air into a conditioned space or through a duct or ducts. Note that 248 CMR and/or 527 CMR may have a definition for "Furnace" that is different than the Seventh Edition, Massachusetts Building Code for One- and Two-family Dwellings (780 CMR) definition.*

GLAZING AREA. The interior surface area of all glazed fenestration, including the area of sash, curbing or other framing elements, that enclose conditioned space. Includes the area of glazed fenestration assemblies in walls bounding conditioned basements. *For purposes of energy conservation, in doors where the daylight opening area is less than 50% of the door area, the glazing area is the daylight opening area. For all other doors, the glazing area is the rough opening area for the door including the door and the frame.*

GRADE. The finished ground level adjoining the building at all exterior walls.

GRADE FLOOR OPENING. A window or other opening located such that the sill height of the opening is not more than 44 inches (1118 mm) above or below the finished ground level adjacent to the opening.

[B] GRADE PLANE. A reference plane representing the average of the finished ground level adjoining the building at all exterior walls. Where the finished ground level slopes away from the exterior walls, the reference plane shall be established by the lowest points within the area between the building and the lot line or, where the lot line is more than six feet (1829 mm) from the building between the structure and a point six feet (1829 mm) from the building.

GREENHOUSE. *An enclosed detached or attached accessory structure consisting primarily of light-transmitting materials and used exclusively for growing plants. In accordance with St. 1973, c. 672, the provisions of 780 CMR 51.00 through 99.00 shall not apply to greenhouses covered exclusively with plastic film; however, the provisions of M.G.L. c. 40A shall continue to apply*

GROSS AREA OF EXTERIOR WALLS. The normal projection of all exterior walls, including the area of all windows and doors installed therein.

GROSS FLOOR AREA. *The sum of the areas of all floors of the building, including basements, cellars, mezzanine and intermediate floored tiers and penthouses of headroom height, measured from the exterior faces of exterior walls or from the centerline of walls separating buildings, but excluding:*

1. Covered walkways, open roofed-over areas, porches and similar spaces.
2. Pipe trenches, exterior terraces or steps,

chimneys, roof overhangs and similar features.

GROUND-SOURCE HEAT PUMP LOOP SYSTEM. Piping buried in horizontal or vertical excavations or placed in a body of water for the purpose of transporting heat transfer liquid to and from a heat pump. Included in this definition are closed loop systems in which the liquid is recirculated and open loop systems in which the liquid is drawn from a well or other source.

GUARD. A building component or a system of building components located near the open sides of elevated walking surfaces that minimizes the possibility of a fall from the walking surface to the lower level.

[B] HABITABLE SPACE. A space in a building for living, sleeping, eating or cooking. Bathrooms, toilet rooms, closets, halls, storage or utility spaces and similar areas are not considered habitable spaces.

[B] HANDRAIL. A horizontal or sloping rail intended for grasping by the hand for guidance or support.

HANGERS. See "Supports."

HAZARDOUS LOCATION. Any location considered to be a fire hazard for flammable vapors, dust, combustible fibers or other highly combustible substances.

HEAT. *The form of energy that is transferred by virtue of a temperature difference or a change in state of a material.*

HEATING DEGREE DAYS (HDD). The sum, on an annual basis, of the difference between 65°F (18°C) and the mean temperature for each day as determined from "NOAA Annual Degree Days to Selected Bases Derived from the 1960-1990 Normals" or other weather data sources acceptable to the code official.

HEAT TRAP. *An arrangement of piping and fittings, such as elbows, or a commercially available product, that prevents thermosiphoning of hot water during standby periods.*

HEATED SLAB. *Slab-on-grade construction in which the heating elements or hot air distribution system is in contact with or placed within the slab or the subgrade.*

HEATED SPACE. *Space within a building which is provided with a positive heat supply (see "Positive heating supply"). Finished living space within a basement with registers or heating devices designed to supply heat to a basement space shall automatically define that space as heated space.*

HEAT PUMP. An appliance having heating or heating/cooling capability and that uses refrigerants to extract heat from air, liquid or other sources.

HEATING SEASONAL PERFORMANCE FACTOR (HSPF). *The total heating output of a heat pump during its normal annual usage period for heating, in Btu, divided by the total electric energy input during the same period, in watt hours, as determined by DOE 10 CFR Part 430, Subpart B, Test Procedures, and based on Region 4.*

[B] HEIGHT, BUILDING. The vertical distance from grade plane to the average height of the highest roof surface.

[B] HEIGHT, STORY. The vertical distance from top to top of two successive tiers of beams or finished floor surfaces; and, for the topmost story, from the top of the floor finish to the top of the ceiling joists or, where there is not a ceiling, to the top of the roof rafters.

HIGH-TEMPERATURE (H.T.) CHIMNEY. A high temperature chimney complying with the requirements of UL 103. A Type H.T. chimney is identifiable by the markings "Type H.T." on each chimney pipe section.

HOT WATER. Water at a temperature greater than or equal to 110°F (43°C).

HUMIDISTAT. *A regulatory device, actuated by changes in humidity, used for automatic control of relative humidity.*

HVAC. *Heating, ventilating and air conditioning.*

HVAC SYSTEM. *The equipment, distribution network and terminals that provide either collectively or individually the processes of heating, ventilating or air conditioning to a building or portion of a building.*

HVAC SYSTEM COMPONENTS. *HVAC system components provide, in one or more factory-assembled packages, means for chilling or heating water, or both, with controlled temperature for delivery to terminal units serving the conditioned spaces of the building. Types of HVAC system components include, but are not limited to, water chiller packages, reciprocating condensing units and water source (hydronic) heat pumps (see "HVAC system equipment").*

HVAC SYSTEM EQUIPMENT. *HVAC system equipment provides, in one (single package) or more (split system) factory-assembled packages, means for air circulation, air cleaning, air cooling with controlled temperature and dehumidification and, optionally, either alone or in combination with a heating plant, the functions of heating and humidifying. The cooling function is either electrically or heat operated and the refrigerant condenser is air, water or evaporatively cooled. Where the equipment is provided in more than one package, the separate packages shall be designed by the manufacturer to be used together. The equipment shall be permitted to provide the heating*

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function as a heat pump or by the use of electric or fossil-fuel-fired elements. (The word "equipment" used without a modifying adjective, in accordance with common industry usage, applies either to HVAC system equipment or HVAC system.)

HURRICANE-PRONE REGIONS. Areas vulnerable to hurricanes, defined as the U.S. Atlantic Ocean and Gulf of Mexico coasts where the basic wind speed is greater than 90 miles per hour (177 km/h), and Hawaii, Puerto Rico, Guam, Virgin Islands, and America Samoa.

HYDROGEN GENERATING APPLIANCE. A self-contained package or factory-matched packages of integrated systems for generating gaseous hydrogen. Hydrogen generating appliances utilize electrolysis, reformation, chemical, or other processes to generate hydrogen.

IGNITION SOURCE. A flame, spark or hot surface capable of igniting flammable vapors or fumes. Such sources include appliance burners, burner ignitions and electrical switching devices.

INDIVIDUAL WATER SUPPLY. A supply other than an approved public water supply that serves one or more families.

INFILTRATION. *The uncontrolled inward air leakage through cracks and interstices in any building element and around windows and doors of a building caused by the pressure effects of wind or the effect of differences in the indoor and outdoor air density or both.*

INSPECTOR OF BUILDINGS. *The administrative chief of the building department in a municipality who is charged with the administration and enforcement of 780 CMR 51.00 through 99.00 (see also "Building commissioner" and "Building code enforcement official"). All inspectors of buildings shall meet or exceed the minimum qualifications defined by M.G.L. c. 143, § 3 and shall be certified in accordance with Special Regulation 780 CMR 110.R7.*

INSULATING CONCRETE FORM (ICF). A concrete forming system using stay-in-place forms of rigid foam plastic insulation, a hybrid of cement and foam insulation, a hybrid of cement and wood chips, or other insulating material for constructing cast-in-place concrete walls.

INSULATING SHEATHING. An insulating board having a minimum thermal resistance of R-2 of the core material.

JURISDICTION. The governmental unit that has adopted 780 CMR 51.00 through 99.00 under due legislative authority.

KITCHEN. Kitchen shall mean an area used, or designated to be used, for the preparation of food.

[B] LABEL. An identification applied on a product by the manufacturer which contains the name of the manufacturer, the function and performance characteristics of the product or material, and the name and identification of an approved agency and that indicates that the representative sample of the product or material has been tested and evaluated by an approved agency. (See also "Manufacturer's designation" and "Mark.")

LABELED. Devices, equipment or materials to which have been affixed a label, seal, symbol or other identifying mark of a testing laboratory, inspection agency or other organization concerned with product evaluation that maintains periodic inspection of the production of the above labeled items that attests to compliance with a specific standard.

LIGHT-FRAMED CONSTRUCTION. A type of construction whose vertical and horizontal structural elements are primarily formed by a system of repetitive wood or light gage steel framing members.

LISTED AND LISTING. Terms referring to equipment that is shown in a list published by an approved testing agency qualified and equipped for experimental testing and maintaining an adequate periodic inspection of current productions and whose listing states that the equipment complies with nationally recognized standards when installed in accordance with the manufacturer's installation instructions.

[B] LIVE LOADS. Those loads produced by the use and occupancy of the building or other structure and do not include construction or environmental loads such as wind load, snow load, rain load, earthquake load, flood load or dead load.

LIVING SPACE. Space within a dwelling unit utilized for living, sleeping, eating, cooking, bathing, washing and sanitation purposes.

LOCAL ENFORCEMENT AGENCY. *A department or agency in a municipality charged with the enforcement of 780 CMR 51.00 through 99.00 and appropriate specialized codes which include, but are not limited to, 248 CMR, the State Plumbing and Gas Fitting Code, and 527 CMR 12.00, the State Electrical Code.*

LOCAL INSPECTOR. *A person in the municipality who assists the building commissioner or inspector of buildings in the performance of his or her duties and is charged with the enforcement of 780 CMR 51.00 through 99.00. All local inspectors shall meet or exceed the minimum qualifications defined by M.G.L. c. 143, § 3 and shall be certified in accordance with Special Regulation 110.R7.*

[B] LOT. A portion or parcel of land considered as a unit.

[B] LOT LINE. A line dividing one lot from another, or from a street or any public place.

LOW-RISE RESIDENTIAL BUILDING. *For purposes of energy conservation requirements only, residential occupancy buildings three stories or less in height (also see 780 CMR 61.00 for exceptions to this classification).*

MANUAL. *Capable of being operated by personal intervention (see "Automatic").*

MANUFACTURED BUILDING. *Any building which has concealed elements, such as electrical, mechanical, plumbing, fire protection, insulation and other systems affecting health and safety, and which is manufactured and assembled in manufacturing facilities, on or off the building site. Also, any building as defined above which does not have concealed elements, but which has been approved by the BBRS at the request of the manufacturer.*

MANUFACTURED HOME. Manufactured home means a structure, transportable in one or more sections, which in the traveling mode is eight body feet (2438 body mm) or more in width or 40 body feet (12 192 body mm) or more in length, or, when erected on site, is 320 square feet (30 m²) or more, and which is built on a permanent chassis and designed to be used as a dwelling with or without a permanent foundation when connected to the required utilities, and includes the plumbing, heating, air-conditioning and electrical systems contained therein; except that such term shall include any structure that meets all the requirements of this paragraph except the size requirements and with respect to which the manufacturer voluntarily files a certification required by the secretary (HUD) and complies with the standards established under this title. For mobile homes built prior to June 15, 1976, a label certifying compliance to the Standard for Mobile Homes, NFPA 501, in effect at the time of manufacture is required. For the purpose of 780 CMR 51.00 through 99.00, a mobile home shall be considered a manufactured home.

[B] MANUFACTURER'S DESIGNATION. An identification applied on a product by the manufacturer indicating that a product or material complies with a specified standard or set of rules. (See also "Mark" and "Label.")

MANUFACTURER'S INSTALLATION INSTRUCTIONS. Printed instructions included with equipment as part of the conditions of listing and labeling.

[B] MARK. An identification applied on a product by the manufacturer indicating the name of the manufacturer and the function of a product or material. (See also "Manufacturer's designation" and "Label.")

MASONRY CHIMNEY. A field-constructed chimney composed of solid masonry units, bricks,

stones or concrete.

MASONRY HEATER. A masonry heater is a solid fuel burning heating appliance constructed predominantly of concrete or solid masonry having a mass of at least 1,100 lb. (500 kg), excluding the chimney and foundation. It is designed to absorb and store a substantial portion of heat from a fire built in the firebox by routing exhaust gases through internal heat exchange channels in which the flow path downstream of the firebox includes at least one 180-degree (3.14-rad) change in flow direction before entering the chimney and which deliver heat by radiation through the masonry surface of the heater.

MASONRY, SOLID. Masonry consisting of solid masonry units laid contiguously with the joints between the units filled with mortar.

[B] MASONRY UNIT. Brick, tile, stone, glass block or concrete block conforming to the requirements specified in the *International Building Code* Section 2103.

Clay. A building unit larger in size than a brick, composed of burned clay, shale, fire clay or mixtures thereof.

Concrete. A building unit or block larger in size than 12 inches by four inches by four inches (305 mm by 102 mm by 102 mm) made of cement and suitable aggregates.

Glass. Nonload-bearing masonry composed of glass units bonded by mortar.

Hollow. A masonry unit whose net cross-sectional area in any plane parallel to the loadbearing surface is less than 75% of its gross cross-sectional area measured in the same plane.

Solid. A masonry unit whose net cross-sectional area in every plane parallel to the loadbearing surface is 75% or more of its cross-sectional area measured in the same plane.

MASS WALL. Masonry or concrete walls having a mass greater than or equal to 30 pounds per square foot (146 kg/m²), solid wood walls having a mass greater than or equal to 20 pounds per square foot (98 kg/m²), and any other walls having a heat capacity greater than or equal to six Btu/ft² · °F [266 J/(m² · k)].

MEAN ROOF HEIGHT. The average of the roof eave height and the height to the highest point on the roof surface, except that eave height shall be used for roof angle of less than or equal to 10 degrees (0.18 rad).

MECHANICAL DRAFT SYSTEM. A venting system designed to remove flue or vent gases by mechanical means, that consists of an induced draft portion under nonpositive static pressure or a forced draft portion under positive static pressure.

Forced-draft Venting System. A portion of a venting system using a fan or other mechanical

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means to cause the removal of flue or vent gases under positive static pressure.

Induced Draft Venting System. A portion of a venting system using a fan or other mechanical means to cause the removal of flue or vent gases under nonpositive static vent pressure.

Power Venting System. A portion of a venting system using a fan or other mechanical means to cause the removal of flue or vent gases under positive static vent pressure.

MECHANICAL EXHAUST SYSTEM. A system for removing air from a room or space by mechanical means.

MECHANICAL SYSTEM. A system specifically addressed and regulated in 780 CMR 51.00 through 99.00 and composed of components, devices, appliances and equipment.

[B] METAL ROOF PANEL. An interlocking metal sheet having a minimum installed weather exposure of at least three square feet (0.28 m²) per sheet.

[B] METAL ROOF SHINGLE. An interlocking metal sheet having an installed weather exposure less than three square feet (0.28 m²) per sheet.

[B] MEZZANINE, LOFT. An intermediate level or levels between the floor and ceiling of any story with an aggregate floor area of not more than one-third of the area of the room or space in which the level or levels are located.

[B] MODIFIED BITUMEN ROOF COVERING. One or more layers of polymer modified asphalt sheets. The sheet materials shall be fully adhered or mechanically attached to the substrate or held in place with an approved ballast layer.

MULTIPLE STATION SMOKE ALARM. Two or more single station alarm devices that are capable of interconnection such that actuation of one causes all integral or separate audible alarms to operate.

NATIVE LUMBER. *Native lumber is wood processed in the Commonwealth of Massachusetts by a mill registered in accordance with Special Regulation 780 CMR 110.R4. Such wood is ungraded but is stamped or certified in accordance with the requirements of Special Regulation 780 CMR 110.R4. For the purpose of this definition, native lumber shall be restricted to the use in one- and two-story dwellings, barns, sheds, agricultural and accessory buildings and other structures when permitted by Special Regulation 780 CMR 110.R4.*

NATURAL DRAFT SYSTEM. A venting system designed to remove flue or vent gases under nonpositive static vent pressure entirely by natural draft.

NONCOMBUSTIBLE MATERIAL. Materials that pass the test procedure for defining noncombustibility of elementary materials set forth in ASTM E 136.

NONCONDITIONED SPACE. A space that is not a conditioned space by insulated walls, floors or ceilings.

OCCUPANCY. *The purpose for which a building, or portion thereof, is utilized or occupied.*

[B] OCCUPIED SPACE. The total area of all buildings or structures on any lot or parcel of ground projected on a horizontal plane, excluding permitted projections as allowed by 780 CMR 51.00 through 99.00.

OFFICIAL INTERPRETATION. *A written interpretation made by the BBRS, under authority of M.G.L. c. 143, § 94(e), or by the State Building Code Appeals Board under authority of M.G.L. c. 143, § 100 of any provision of 780 CMR 51.00 through 99.00, or its referenced standards as listed in Appendix A, except the specialized codes.*

OPAQUE AREAS. *All exposed areas of a building envelope which enclose conditioned space, except openings for windows, skylights, doors and building service systems.*

OWNER. *Every person who alone or jointly or severally with others*

1. *has legal title to any building or structure; or*
2. *has care, charge or control of any building or structure in any capacity including, but not limited to, agent, executor, executrix, administrator, administratrix, trustee or guardian of the estate of the holder of legal title; or*
3. *lessee under a written lease agreement; or*
4. *mortgagee in possession; or*
5. *agent, trustee or other person appointed by the courts.*

Each such person is bound to comply with the provisions of 780 CMR 51.00 through 99.00.

PELLET FUEL-BURNING APPLIANCE. A closed combustion, vented appliance equipped with a fuel feed mechanism for burning processed pellets of solid fuel of a specified size and composition.

PELLET VENT. A vent listed and labeled for use with a listed pellet fuel-burning appliance.

[B] PERMIT. An official document or certificate issued by the authority having jurisdiction that authorizes performance of a specified activity.

PERSON. *Includes a corporation, firm, partnership, association, organization and any other group acting as a unit as well as individuals. It shall also include an executor, administrator, trustee, receiver or other representative appointed according to law. Whenever the word "person" is used in any section of 780 CMR 51.00 through 99.00 prescribing a penalty or fine, as to partner-*

ships or associations, the word shall include the partners or members thereof, and as to corporations, shall include the officer, agent or members thereof who are responsible for any violation of such section.

PITCH. See "Slope."

PLATFORM CONSTRUCTION. A method of construction by which floor framing bears on load bearing walls that are not continuous through the story levels or floor framing.

PLENUM. A chamber that forms part of an air-circulation system other than the occupied space being conditioned.

PLUMBING. For the purpose of 780 CMR 51.00 through 99.00, plumbing refers to those installations, repairs, maintenance and alterations regulated by 248 CMR, *Commonwealth of Massachusetts Fuel Gas and Plumbing Code*.

PORTABLE FUEL CELL APPLIANCE. A fuel cell generator of electricity, which is not fixed in place. A portable fuel cell appliance utilizes a cord and plug connection to a grid-isolated load and has an integral fuel supply.

POSITIVE COOLING SUPPLY. *Mechanical cooling deliberately supplied to a space, such as through a supply register. Also, mechanical cooling indirectly supplied to a space through uninsulated surfaces of space-cooling components, such as evaporator coil cases and cooling distribution systems which continually maintain air temperatures within the space of 85°F (29°C) or lower during normal operation. To be considered exempt from inclusion in this definition, such surfaces shall comply with the insulation requirements of 780 CMR 51.00 through 99.00.*

POSITIVE HEAT SUPPLY. *Heat deliberately supplied to a space by design, such as a supply register, radiator or heating element. Also, heat indirectly supplied to a space through uninsulated surfaces of service water heaters and space-heating components, such as furnaces, boilers and heating and cooling distribution systems which continually maintain air temperature within the space of 50 °F (10°C) or higher during normal operation. To be considered exempt from inclusion in this definition, such surfaces shall comply with the insulation requirements of 780 CMR 51.00 through 99.00.*

[B] POSITIVE ROOF DRAINAGE. The drainage condition in which consideration has been made for all loading deflections of the roof deck, and additional slope has been provided to ensure drainage of the roof within 48 hours of precipitation.

POTABLE WATER. Water free from impurities present in amounts sufficient to cause disease or

harmful physiological effects and conforming in bacteriological and chemical quality to the requirements of the public health authority having jurisdiction.

PRESSURE-RELIEF VALVE. A pressure-actuated valve held closed by a spring or other.

PUBLIC SEWER. A common sewer directly controlled by public authority.

PUBLIC WAY. Any street, alley or other parcel of land open to the outside air leading to a public street, which has been deeded, dedicated or otherwise permanently appropriated to the public for public use and that has a clear width and height of not less than ten feet (3048 mm).

PURGE. To clear of air, gas or other foreign substances.

RADON GAS. *A naturally occurring, chemically inert, radioactive gas that is not detectable by human senses. As a gas, it can move readily through particles of soil and rock and can accumulate under the slabs and foundations of homes where it can easily enter into the living space through construction cracks and openings. Radon mitigation is not a requirement of 780 CMR 51.00 through 99.00. Persons interested in acquiring information about radon mitigation may contact the U.S. Environmental Protection Agency (EPA).*

R-VALUE, THERMAL RESISTANCE. The inverse of the time rate of heat flow through a building thermal envelope element from one of its bounding surfaces to the other for a unit temperature difference between the two surfaces, under steady state conditions, per unit area ($h \cdot ft^2 \cdot ^\circ F/Btu$).

RAMP. A walking surface that has a running slope steeper than one unit vertical in 20 units horizontal (5% slope).

[B] REGISTERED DESIGN PROFESSIONAL. An individual who is registered or licensed to practice *his or her* respective design profession as defined by the statutory requirements of the professional registration laws of the *Commonwealth of Massachusetts*.

RELIEF VALVE, VACUUM. A device to prevent excessive buildup of vacuum in a pressure vessel.

RENEWABLE ENERGY SOURCES. *Sources of energy (excluding minerals) derived from incoming solar radiation, including natural daylighting and photosynthetic processes; from phenomena resulting therefrom, including wind, waves and tides, lake or pond thermal differences; and from the internal heat of the earth, including nocturnal thermal exchanges.*

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[EB] REPAIR. The reconstruction or renewal of any part of an existing building for the purpose of its maintenance.

REPAIRS, ORDINARY. *Any maintenance which does not affect the structure, egress, fire protection systems, fire ratings, energy conservation provisions, plumbing, sanitary, gas, electrical or other utilities. A building permit is not required for ordinary repairs.*

[B] REROOFING. The process of recovering or replacing an existing roof covering. *See* "Roof recover."

RESIDENTIAL BUILDING TYPE. *Detached one- and two-family dwellings are Type A-1. (Three or more family dwelling units, including apartment buildings, hotels, motels, "rowhousing" and "townhousing" are addressed in the Seventh Edition of the Massachusetts Basic Building Code).*

RETURN AIR. Air removed from an approved conditioned space or location and recirculated or exhausted.

[B] ROOF ASSEMBLY. *A system designed to provide weatherprotection and resistance to design loads. The system consists of a roof covering and roof deck or a single component serving as both the roof covering and the roof deck. A roof assembly includes the roof deck, vapor retarder, substrate or thermal barrier, insulation, vapor retarder and roof covering. For purposes of addressing 780 CMR 61.00 energy conservation requirements a roof assembly shall be considered as all roof/ceiling components of the building envelope through which heatflows, thus creating a building transmission heat loss or gain, where such assembly is exposed to outdoor air and encloses conditioned space.*

The gross area of a roof assembly consists of the total interior surface of all roof/ceiling components, including opaque surfaces, dormer and bay window roofs, treyed ceilings, overhead portions of an interior stairway to an unconditioned attic, doors and hatches, glazing and skylights exposed to conditioned space, that are horizontal or sloped at an angle less than 60 degrees (1.1 rad) from the horizontal (see "Exterior wall"). A roof assembly, or portions thereof, having a slope of 60 degrees (1.1 rad) or greater from horizontal shall be considered in the gross area of exterior walls and thereby excluded from consideration in the roof assembly. Skylight shaft walls 12 inches (305 mm) in depth or greater (as measured from the ceiling plane to the roofdeck) shall be considered in the gross area of exterior walls and are thereby excluded from consideration in the roof assembly.

[B] ROOF COVERING. The covering applied to the roof deck for weather resistance, fire classification or appearance.

[B] ROOF COVERING SYSTEM. *See* "Roof assembly".

[B] ROOF DECK. The flat or sloped surface not including its supporting members or vertical supports.

[B] ROOF RECOVER. The process of installing an additional roof covering over a prepared existing roof covering without removing the existing roof covering.

[B] ROOF REPAIR. Reconstruction or renewal of any part of an existing roof for the purposes of its maintenance.

[B] ROOFTOP STRUCTURE. An enclosed structure on or above the roof of any part of a building.

ROOM HEATER. A freestanding heating appliance installed in the space being heated and not connected to ducts.

[B] RUNNING BOND. The placement of masonry units such that head joints in successive courses are horizontally offset at least one-quarter the unit length.

SASH CRACK. *The sum of all perimeters of all window sashes, based on overall dimensions of such parts, expressed in feet (mm). If a portion of one sash perimeter overlaps a portion of another sash perimeter, only count the length of the overlapping portions once.*

[B] SCUPPER. *An opening in a wall or parapet that allows water to drain from a roof.*

SEASONAL ENERGY EFFICIENCY RATIO (SEER). *The total cooling output of an air conditioner during its normal annual usage period for cooling, in Btu/h (W), divided by the total electric energy input during the same period, in watt-hours, as determined by DOE 10 CFR Part 430, Subpart B, Test Procedures.*

SEISMIC DESIGN CATEGORY. A classification assigned to a structure based on its Seismic Group and the severity of the design earthquake ground motion at the site.

SHALL. The term, when used in 780 CMR 51.00 through 99.00, is construed as mandatory.

[B] SHEAR WALL. A general term for walls that are designed and constructed to resist racking from seismic and wind by use of masonry, concrete, cold-formed steel or wood framing in accordance with 780 CMR 56 of 780 CMR 51.00 through 99.00 and the associated limitations in 780 CMR 5301.2.

SIMULATION TOOL. *An approved software program or calculation-based methodology that projects the hour-by-hour loads and annual energy use of a building.*

SINGLE PLY MEMBRANE. A roofing membrane that is field applied using one layer of membrane material (either homogeneous or composite) rather than multiple layers.

SINGLE STATION SMOKE ALARM. An assembly incorporating the detector, control equipment and alarm sounding device in one unit that is operated from a power supply either in the unit or obtained at the point of installation.

SKYLIGHT AND SLOPED GLAZING. See 780 CMR 5308.6.1.

SKYLIGHT, UNIT. See 780 CMR 5308.6.1.

SLAB-ON-GRADE FLOOR INSULATION. *Insulation around the perimeter of the floor slab or its supporting foundation when the top edge of the floor perimeter slab is above the finished grade or 12 inches (305mm) or less below the finished grade.*

SLOPE. The fall (pitch) of a line of pipe in reference to a horizontal plane. In drainage, the slope is expressed as the fall in units vertical per units horizontal (percent) for a length of pipe.

SMOKE-DEVELOPED RATING. A numerical index indicating the relative density of smoke produced by burning assigned to a material tested in accordance with ASTM E 84.

SOLAR ENERGY SOURCE. *Source of natural daylighting and of thermal, chemical or electrical energy derived directly from conversion of incident solar radiation.*

SOLAR HEAT GAIN COEFFICIENT (SHGC). The solar heat gain through a fenestration or glazing assembly relative to the incident solar radiation ($\text{Btu/h} \cdot \text{ft}^2 \cdot ^\circ\text{F}$).

SOLID MASONRY. Load-bearing or nonload-bearing construction using masonry units where the net cross-sectional area of each unit in any plane parallel to the bearing surface is not less than 75% of its gross cross-sectional area. Solid masonry units shall conform to ASTM C 55, C 62, C 73, C 145 or C 216.

SPECIALIZED CODE. *All building codes, rules or regulations pertaining to building construction, reconstruction, alteration, repair or demolition promulgated by and under the authority of the various agencies which have been authorized from time to time by the General Court of the Commonwealth of Massachusetts.*

STACK. Any main vertical DWV line, including offsets, that extends one or more stories as directly as possible to its vent terminal.

[B] STACK BOND. The placement of masonry units in a bond pattern is such that head joints in successive courses are vertically aligned. For the

purpose of 780 CMR 51.00 through 99.00, requirements for stack bond shall apply to all masonry laid in other than running bond.

STANDARD DESIGN. *A version of the proposed design that meets the minimum requirements of 780 CMR 51.00 through 99.00 and is used to determine the maximum annual energy cost requirement for compliance based on total building performance.*

STANDARD TRUSS. Any construction that does not permit the roof/ceiling insulation to achieve the required R-value over the exterior walls.

STATE BUILDING CODE (780 CMR 51.00 through 99.00). *The Massachusetts State Building Code and amendments and rules and regulations thereto as promulgated by the State Board of Building Regulations and Standards, under M.G.L. c. 143, §§ 93 through 100.*

STATE INSPECTOR. *An employee of the Division of Inspection, Department of Public Safety, who is charged with administrating and enforcing 780 CMR 51.00 through 99.00 relative to any structure or building or parts thereof that are owned by the Commonwealth or any departments, commissions, agencies or authorities of the Commonwealth. The state inspector is also charged with supervising the enforcement of 780 CMR 51.00 through 99.00 relative to all buildings and structures other than those owned by the Commonwealth.*

STATIONARY FUEL CELL POWER PLANT. A self-contained package or factory-matched packages which constitute an automatically-operated assembly of integrated systems for generating useful electrical energy and recoverable thermal energy that is permanently connected and fixed in place.

[B] STORY. That portion of a building included between the upper surface of a floor and the upper surface of the floor or roof next above.

[B] STORY ABOVE GRADE. Any story having its finished floor surface entirely above grade, except that a basement shall be considered as a story above grade where the finished surface of the floor above the basement is:

1. More than six feet (1829 mm) above grade plane.
2. More than six feet (1829 mm) above the finished ground level for more than 50% of the total building perimeter.
3. More than 12 feet (3658 mm) above the finished ground level at any point.

STRUCTURAL INSULATED PANELS (SIPS). Factory fabricated panels of solid core insulation with structural skins of oriented strand board (OSB) or plywood.

STRUCTURE. That which is built or constructed.

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SUNROOM. *An addition to an existing building/dwelling unit where the total glazing area of said addition exceeds 40% of the combined gross wall and ceiling area of the addition.*

SUNROOM ADDITION. A one-story structure added to an existing dwelling with a glazing area in excess of 40% of the gross area of the structure's exterior walls and roof.

SUPPLY AIR. Air delivered to a conditioned space through ducts or plenums from the heat exchanger of a heating, cooling or ventilating system.

SUPPORTS. Devices for supporting, hanging and securing pipes, fixtures and equipment.

SYSTEM. *A combination of central or terminal equipment or components or controls, accessories, interconnecting means and terminal devices by which energy is transformed so as to perform a specific function, such as HVAC, service water heating or illumination.*

THERMAL CONDUCTANCE. *Time rate of heat flow through a body (frequently per unit area) from one of its bounding surfaces to the other for a unit temperature difference between the two surfaces, under steady conditions ($\text{Btu/h} \cdot \text{ft}^2 \cdot ^\circ\text{F}$) [$\text{W}/(\text{m}^2 \cdot \text{K})$].*

THERMOSTAT. *An automatic control device actuated by temperature and designed to be responsive to temperature.*

TRAVEL TRAILER. *A vehicular, portable structure built on a chassis and designed to be used for temporary occupancy for travel, recreational or vacation use; with the manufacturer's permanent identification "Travel Trailer" thereon; and when factory equipped for the road, being of any length provided its gross weight does not exceed 4,500 pounds (2045 kg), or being of any weight provided its overall length does not exceed 28 feet (8534 mm).*

THERMAL ISOLATION. A separation of conditioned spaces, between a sunroom addition and a dwelling unit, consisting of existing or new wall(s), doors, and/or windows.

THERMAL RESISTANCE, R-VALUE. The inverse of the time rate of heat flow through a body from one of its bounding surfaces to the other for a unit temperature difference between the two surfaces, under steady state conditions, per unit area ($\text{h} \cdot \text{ft}^2 \cdot ^\circ\text{F}/\text{Btu}$).

THERMAL TRANSMITTANCE, U-FACTOR. The coefficient of heat transmission (air to air) through a building envelope component or assembly, equal to the time rate of heat flow per unit area and unit temperature difference between the warm side and cold side air films ($\text{Btu/h} \cdot \text{ft}^2 \cdot ^\circ\text{F}$).

TRIM. Picture molds, chair rails, baseboards,

handrails, door and window frames, and similar decorative or protective materials used in fixed applications.

TRUSS DESIGN DRAWING. The graphic depiction of an individual truss, which describes the design and physical characteristics of the truss.

U-FACTOR, THERMAL TRANSMITTANCE. The coefficient of heat transmission (air to air) through a building envelope component or assembly, equal to the time rate of heat flow per unit area and unit temperature difference between the warm side and cold side air films ($\text{Btu/h} \cdot \text{ft}^2 \cdot ^\circ\text{F}$).

UNCONFINED SPACE. A space having a volume not less than 50 cubic feet per 1,000 Btu/h (4.8 m^3/kW) of the aggregate input rating of all appliances installed in that space. Rooms communicating directly with the space in which the appliances are installed, through openings not furnished with doors, are considered a part of the unconfined space.

[B] UNDERLAYMENT. One or more layers of felt, sheathing paper, nonbituminous saturated felt, or other approved material over which a roof covering, with a slope of two to 12 (17% slope) or greater, is applied.

UNITARY COOLING AND HEATING EQUIPMENT. *One or more factory-made assemblies which include an evaporator or cooling coil, a compressor and condenser combination, and which shall be permitted to include a heating function as well. When heating and cooling equipment is provided in more than one assembly, the separate assemblies shall be designed to be used together.*

UNITARY HEAT PUMP. *One or more factory-made assemblies which include an indoor conditioning coil, compressor(s) and outdoor coil or refrigerant-to-water heat exchanger, including means to provide both heating and cooling functions. When heat pump equipment is provided in more than one assembly, the separate assemblies shall be designed to be used together.*

UNUSUALLY TIGHT CONSTRUCTION. Construction meeting the following requirements:

1. Walls comprising the building thermal envelope have a continuous water vapor retarder with a rating of one perm [$57.4 \text{ ng}/(\text{s} \cdot \text{m}^2 \cdot \text{Pa})$] or less with openings therein gasketed or sealed.
2. Doors and openable windows meet the air leakage requirements of International Energy Conservation Code Section 502.1.4.1.
3. Caulking or sealants are applied to areas such as joints around window and door frames between sole plates and floors, between wall-ceiling joints, between wall panels, at penetrations for plumbing, electrical and gas lines, and at other openings.

ADMINISTRATION FOR SINGLE- AND TWO-FAMILY DWELLINGS

VAPOR PERMEABLE MEMBRANE. A material or covering having a permeance rating of 5 perms ($52.9 \cdot 10^{-10} \text{ kg/Pa} \cdot \text{s} \cdot \text{m}^2$) or greater, when tested in accordance with the dessicant method using Procedure A of ASTM E96. A vapor permeable material permits the passage of moisture vapor.

[B] VAPOR RETARDER. A vapor resistant material, membrane or covering such as foil, plastic sheeting, or insulation facing having a permeance rating of 1 perm ($5.7 \cdot 10^{-11} \text{ kg/Pa} \cdot \text{s} \cdot \text{m}^2$) or less, when tested in accordance with the desiccant method using Procedure A of ASTM E 96. Vapor retarders limit the amount of moisture vapor that passes through a material or wall assembly.

VENT. A passageway for conveying flue gases from fuel-fired appliances, or their vent connectors, to the outside atmosphere.

VENT COLLAR. See "Flue collar."

VENT CONNECTOR. That portion of a venting system which connects the flue collar or draft hood of an appliance to a vent.

VENT DAMPER DEVICE, AUTOMATIC. A device intended for installation in the venting system, in the outlet of an individual, automatically operated fuel burning appliance and that is designed to open the venting system automatically when the appliance is in operation and to close off the venting system automatically when the appliance is in a standby or shutdown condition.

VENT GASES. Products of combustion from fuel-burning appliances, plus excess air and dilution air, in the venting system above the draft hood or draft regulator.

VENT STACK. A vertical vent pipe installed to provide circulation of air to and from the drainage system and which extends through one or more stories.

VENT SYSTEM. Piping installed to equalize pneumatic pressure in a drainage system to prevent trap seal loss or blow-back due to siphonage or back pressure.

[B] VENTILATION. The natural or mechanical process of supplying conditioned or unconditioned air to, or removing such air from, any space.

VENTING. Removal of combustion products to the outdoors.

VENTING SYSTEM. A continuous open passageway from the flue collar of an appliance to the outside atmosphere for the purpose of removing flue or vent gases. A venting system is usually composed of a vent or a chimney and vent connector, if used, assembled to form the open passageway.

VERTICAL PIPE. Any pipe or fitting that makes

an angle of 45 degrees (0.79 rad) or more with the horizontal.

[B] WALLS. Walls shall be defined as follows:

Load-bearing Wall is a wall supporting any vertical load in addition to its own weight.

Nonbearing Wall is a wall which does not support vertical loads other than its own weight.

WIND BORNE DEBRIS REGION. Areas within hurricane-prone regions within one mile of the coastal mean high water line where the basic wind speed is 110 miles per hour (177 km/h) or greater; or where the basic wind speed is equal to or greater than 120 miles per hour (193 km/h); or Hawaii. The coastal mean high water line, in the Massachusetts 110 mph wind zones, forms the outer edge of the red bands overlaid onto the satellite images found on the MA Department of Public Safety website at www.mass.gov/dps. For estimating purposes, the inner edge of the red bands is approximately one mile inland from coastal mean high water. For buildings in close proximity to the inner edge of the red band, to determine whether a building is in a wind borne debris region, the building official shall use a survey, provided with the permit application and the building plan, which indicates the distance, in feet, from the location of the proposed building to the closest location of the coastal mean high water line as described.

WINDER. A tread with non-parallel edges.

[B] WOOD STRUCTURAL PANEL. A panel manufactured from veneers; or wood strands or wafers; bonded together with waterproof synthetic resins or other suitable bonding systems. Examples of wood structural panels are plywood, OSB or composite panels.

WRITTEN NOTICE. A notification in writing delivered in person to the individual or parties intended; or delivered at, or sent by certified or registered mail to the last residential or business address of legal record.

[B] YARD. An open space, other than a court, unobstructed from the ground to the sky, except where specifically provided by 780 CMR 51.00 through 99.00, on the lot on which a building is situated.

ZONE. A space or group of spaces within a building with heating or cooling requirements, or both, sufficiently similar so that comfort conditions can be maintained throughout by a single controlling device.

ZONING. The reservation of certain specified areas within a community or city for buildings and structures, or use of land, for certain purposes with other limitations such as height, lot coverage and other stipulated requirements (see M.G.L. c. 40A and St. 1956, c. 665, as amended).

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780 CMR 53.00

BUILDING PLANNING FOR SINGLE- AND TWO-FAMILY DWELLINGS

780 CMR 5301 DESIGN CRITERIA

5301.1 Design. Buildings and structures, and all parts thereof, shall be constructed to safely support all loads, including dead loads, live loads, roof loads, flood loads, snow loads, wind loads as prescribed by 780 CMR 51.00 through 99.00. The construction of buildings and structures shall result in a system that provides a complete load path capable of transferring all loads from their point of origin through the load-resisting elements to the foundation.

5301.1.1 Alternative Provisions. As an alternative to the requirements in 780 CMR 5301.1 the following standards are permitted subject to the limitations of 780 CMR 51.00 through 99.00 and the limitations therein. In lieu of prescriptive compliance, where engineered design is used in conjunction with these standards the engineered design shall be performed by a Massachusetts-registered professional engineer or architect, employ an appropriate engineering rationale consistent with the standards below and utilize the wind and snow loads set forth in 780 CMR 51.00 through 99.00.

1. American Forest and Paper Association (AF&PA) *Wood Frame Construction Manual* (WFCM).
2. American Iron and Steel Institute (AISI), *Standard for Cold-Formed Steel Framing-Prescriptive Method for One- and Two-family Dwellings* (COFS/PM).

Note that seismic design requirements are not applicable to one- and two-family detached dwellings.

5301.1.2 Construction Systems. The requirements of 780 CMR 51.00 through 99.00 are based on platform and balloon-frame construction for light-frame buildings. The requirements for concrete and masonry buildings are based on a balloon framing system. Other framing systems must have equivalent detailing to ensure force transfer, continuity and compatible deformations.

5301.1.3 Engineered Design. When a building of otherwise conventional construction contains structural elements exceeding the limits of 780 CMR 5301 or otherwise, not conforming to 780 CMR 51.00 through 99.00, these elements shall be designed in accordance with accepted engineering practice. The extent of such design need only demonstrate compliance of nonconventional elements with other applicable provisions and shall be compatible with the performance of the conventional framed system. Engineered

design shall be provided by a Massachusetts-registered professional engineer or architect and shall utilize the wind and snow loads set forth in 780 CMR 51.00 through 99.00.

5301.2 Climatic and Geographic Design Criteria. Buildings shall be constructed in accordance with the provisions of 780 CMR 51.00 through 99.00 as limited by the provisions of 780 CMR 5301; *also see 780 CMR Table 5301.2 (1).*

5301.2.1 Wind Limitations. Buildings and portions thereof shall be limited by wind speed, as defined in 780 CMR Table 5301.2(1), and construction methods in accordance with 780 CMR 51.00 through 99.00. Basic wind speeds shall be determined from 780 CMR Table 5301.2(4). Where different construction methods and structural materials are used for various portions of a building, the applicable requirements of 780 CMR 5301 for each portion shall apply. Where loads for windows, skylights and exterior doors are not otherwise specified, the loads listed in 780 CMR Table 5301.2(2) adjusted for height and exposure per 780 CMR Table 5301.2(3), shall be used to determine design load performance requirements for windows and doors.

5301.2.1.1 Design Criteria. Construction in regions where the basic wind speeds from 780 CMR Table 5301.2(4) equal or exceed 110 miles per hour (177.1 km/h) shall be designed in accordance with one of the following:

1. American Forest and Paper Association (AF&PA) *Wood Frame Construction Manual for One- and Two-Family Dwellings* (WFCM); or
 - 1.1 American Forrester and Paper Association *Guide to Wood Construction in High Wind Areas for One- and Two-Family Dwellings, 110 mph Exposure B*. A Commonwealth of MA version of the checklist can be used in place of the checklist at the end of the guide. The MA version is found in Appendix 780 CMR 120.P
2. *Southern Building Code Congress International Standard for Hurricane Resistant Residential Construction* (SSTD 10); or
3. *Minimum Design Loads for Buildings and Other Structures* (ASCE-7); or
4. American Iron and Steel Institute (AISI), *Standard for Cold-Formed Steel Framing-Prescriptive Method for One- and*

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Two-family Dwellings (COFS/PM).

5. Concrete construction shall be designed in accordance with the provisions of 780 CMR 51.00 through 99.00.

5301.2.1.2 Internal Pressure. Windows in buildings located in wind borne debris regions shall have glazed openings protected from windborne debris or the building shall be

designed as a partially enclosed building in accordance with the *International Building Code but utilizing the wind loads set forth in 780 CMR 51.00 through 99.00*. Glazed opening protection for windborne debris shall meet the requirements of the Large Missile Test of ASTM E 1996 and of ASTM E 1886 referenced therein.

TABLE 5301.2(1)
MASSACHUSETTS CLIMATIC AND GEOGRAPHIC DESIGN CRITERIA

GROUND SNOW LOAD	WIND SPEED* (mph)	SEISMIC DESIGN CATEGORY* (One- and Two- Family Detached Dwellings-only)	SUBJECT TO DAMAGE FROM				WINTER DESIGN TEMP ¹	ICE SHIELD UNDERLAYMENT REQUIRED ²	FLOOD HAZARD ³	AIR FREEZING INDEX ⁴	MEAN ANNUAL TEMP ⁵
			Weathering ⁶	Frost Line Depth ⁷	Termite ⁸	Decay ⁹					
Table 5301.2(5)	Table 5301.2(4)	N/A	Figure 5301.2(3)	4 ft. Minimum unless en- gineered data shows otherwise	Figure 5301.2(6)	Figure 5301.2(7)	Appendix 780 CMR 120.J Table 120.J3.2.1	As required by the exterior roof covering manufacturer; roof pitch and local climate must also be considered	Refer to the applicable Flood Insurance Rate Map (FIRM)	Only utilized in the design and construction of frost-protected shallow foundations	Only utilized in the design and construction of frost-protected shallow foundations

For SF: 1 foot = 304.8 mm.

- Weathering may require a higher strength concrete or grade of masonry than necessary to satisfy the structural requirements of this code. The weathering index ("negligible," "moderate" or "severe") shall be determined from the Weathering Probability Map [Figure 5301.2(3)]. The grade of masonry units shall be determined from ASTM C 34, C 55, C 62, C 73, C 90, C 129, C 145, C 216 or C 652, as applicable.
- The frost line depth shall be a minimum of 4 feet in Massachusetts unless engineering data demonstrates that the frost line depth is less than or greater than 4 feet. Under no circumstances will permanent foundation systems, required to be protected from frost be allowed set at less than 4 feet without engineering design ensuring foundation frost protection.
- Site-specific termite conditions should be determined when possible, otherwise Figure 5301.2(6) shall be utilized.
- Typically "light" to "moderate."
- The basic wind speed shall be determined from Table 5301.2(4) for the specific city or town where construction is intended.
- See Appendix 780 CMR 120.J3.2.1.
- Seismic design is not required for one- and two-family detached dwellings.
- The community Flood Insurance Rate Map (FIRM) shall be utilized to establish the flood hazard.
- The requirements of the manufacturer of the exterior roof covering shall be followed with regard to ice shield underlayment; likewise roof pitch and local climate must be considered.
- Only utilized when one is designing a frost-protected shallow foundation. When applicable, refer to the "100-year return period air freezing index" from Figure 5403.3(2) and for further clarification view the National Climatic Data Center data table "Air Freezing Index-USA Method (Base 32° Fahrenheit)" at www.ncdc.noaa.gov/fpsf.html.
- Only utilized when one is designing a frost-protected shallow foundation. When applicable, refer to the "100-year return period air freezing index" from Figure 5403.3(2) and for further clarification view the National Climatic Data Center data table "Air Freezing Index-USA Method (Base 32° Fahrenheit)" at www.ncdc.noaa.gov/fpsf.html.

780 CMR TABLE 5301.2(2)
COMPONENT AND CLADDING LOADS FOR A BUILDING WITH A MEAN
ROOF HEIGHT OF 30 FEET LOCATED IN EXPOSURE B (psf)

	ZONE	EFFECTIVE WIND AREA (feet²)	BASIC WIND SPEED (mph—3-second gust)																							
			85		90		100		105		110		120		125		130		140		145		150		170	
Roof > 0 to 10 degrees	1	10	10.0-13.0	10.0-14.6	10.0-18.0	10.0-19.8	10.0-21.8	10.5-25.9	11.4-28.1	12.4-30.4	14.3-35.3	15.4-37.8	16.5-40.5	21.1-52.0												
	1	20	10.0-12.7	10.0-14.2	10.0-17.5	10.0-19.3	10.0-21.2	10.0-25.2	10.7-27.4	11.6-29.6	13.4-34.4	14.4-36.9	15.4-39.4	19.8-50.7												
	1	50	10.0-12.2	10.0-13.7	10.0-16.9	10.0-18.7	10.0-20.5	10.0-24.4	10.0-26.4	10.6-28.6	12.5-33.3	13.1-35.6	14.1-38.1	18.1-48.9												
	1	100	10.0-11.9	10.0-13.3	10.0-18.5	10.0-18.2	10.0-19.9	10.0-23.7	10.0-25.7	10.0-27.8	11.4-32.3	12.2-34.6	13.0-37.0	16.7-47.6												
	2	10	10.0-21.8	10.0-24.4	10.0-30.2	10.0-33.3	10.0-36.5	10.5-43.5	11.4-47.2	12.4-51.0	14.3-59.2	15.4-63.5	16.5-67.9	21.1-87.2												
	2	20	10.0-19.5	10.0-21.8	10.0-27.0	10.0-29.7	10.0-32.6	10.0-38.8	10.7-42.1	11.6-45.6	13.4-52.0	14.4-56.7	15.4-60.7	19.8-78.0												
	2	50	10.0-16.4	10.0-18.4	10.0-22.7	10.0-25.1	10.0-27.5	10.0-32.7	10.0-35.5	10.6-38.4	12.3-44.5	13.1-47.8	14.1-51.1	18.1-65.7												
	2	100	10.0-14.1	10.0-15.8	10.0-19.5	10.0-21.5	10.0-23.6	10.0-28.1	10.0-30.5	10.0-33.0	11.4-38.2	12.2-41.0	13.0-43.9	16.7-56.4												
	3	10	10.0-32.8	10.0-36.8	10.0-45.4	10.0-50.1	10.0-55.0	10.5-65.4	11.4-71.0	12.4-76.8	14.3-89.0	15.4-95.5	16.5-102.2	21.1-131.3												
	3	20	10.0-27.2	10.0-30.5	10.0-37.6	10.0-41.5	10.0-45.5	10.0-54.2	10.7-58.8	11.6-63.6	13.4-73.8	14.4-79.1	15.4-84.7	19.8-108.7												
	3	50	10.0-19.7	10.0-22.1	10.0-27.3	10.0-30.1	10.0-33.1	10.0-39.3	10.0-42.7	10.6-46.2	12.3-53.5	13.1-57.4	14.1-61.5	18.1-78.9												
	3	100	10.0-14.1	10.0-15.8	10.0-19.5	10.0-21.5	10.0-23.6	10.0-28.1	10.0-30.5	10.0-33.0	11.4-38.2	12.2-41.0	13.0-43.9	16.7-56.4												
Roof > 10 to 30 degrees	1	10	10.0-11.9	10.0-13.3	10.4-16.5	11.4-18.2	12.5-19.9	14.9-23.7	16.2-25.7	17.5-27.8	20.3-32.3	21.8-35.6	23.3-37.0	30.0-47.6												
	1	20	10.0-11.6	10.0-13.0	10.0-16.0	10.4-17.6	11.4-19.4	13.6-23.0	14.8-25.0	16.0-27.0	18.5-31.4	19.9-33.7	21.3-36.0	27.3-56.3												
	1	50	10.0-11.1	10.0-12.5	10.0-15.4	10.0-17.0	10.0-18.6	11.9-22.2	12.9-24.1	13.9-26.0	16.1-30.2	17.3-32.4	18.5-34.6	23.8-44.5												
	1	100	10.0-10.8	10.0-12.1	10.0-14.9	10.0-16.5	10.0-18.1	10.5-21.5	11.4-23.3	12.4-25.2	14.3-29.3	15.4-31.4	16.5-33.6	21.1-43.2												
	2	10	10.0-25.1	10.0-28.2	10.4-34.8	11.4-38.3	12.5-42.1	14.9-50.1	16.2-54.3	17.5-58.7	20.3-68.1	21.8-73.1	23.3-78.2	30.0-100.5												
	2	20	10.0-22.8	10.0-25.6	10.0-31.5	10.4-34.8	11.4-38.2	13.6-45.4	14.8-49.3	16.0-53.3	18.5-61.8	19.9-66.3	21.3-71.0	27.3-91.2												
	2	50	10.0-19.7	10.0-22.1	10.0-27.3	10.0-30.1	10.0-33.0	11.9-39.3	12.9-42.7	13.9-46.1	16.1-53.5	17.3-57.4	18.5-61.4	23.8-78.9												
	2	100	10.0-17.4	10.0-19.5	10.0-24.1	10.0-26.6	10.0-29.1	10.5-34.7	11.4-37.6	12.4-40.7	14.3-47.2	15.4-50.6	16.5-54.2	21.1-69.6												
	3	10	10.0-25.1	10.0-28.2	10.4-34.8	11.4-38.3	12.5-42.1	14.9-50.1	16.2-54.3	17.5-58.7	20.3-68.1	21.8-73.1	23.3-78.2	30.0-100.5												
	3	20	10.0-22.8	10.0-25.6	10.0-31.5	10.4-34.8	11.4-38.2	13.6-45.4	14.7-49.3	16.0-53.3	18.5-61.8	19.9-66.3	21.3-71.0	27.3-91.2												
	3	50	10.0-19.7	10.0-22.1	10.0-27.3	10.0-30.1	10.0-33.0	11.9-39.3	12.9-42.7	13.9-46.1	16.1-53.5	17.3-57.4	18.5-61.4	23.8-78.9												
	3	100	10.0-17.4	10.0-19.5	10.0-24.1	10.0-26.6	10.0-29.1	10.5-34.7	11.4-37.6	12.4-40.7	14.3-47.2	15.4-50.6	16.5-54.2	21.1-69.6												
Roof > 30 to 45 degrees	1	10	11.9-13.0	13.3-14.6	16.5-18.0	18.2-19.8	19.9-21.8	23.7-25.9	25.7-28.1	27.8-30.4	32.3-35.3	34.6-37.8	37.0-40.5	47.6-52.0												
	1	20	11.6-12.3	13.0-13.8	16.0-17.1	17.6-18.8	19.4-20.7	23.0-24.6	25.0-26.7	27.0-28.9	31.4-33.5	33.7-35.9	36.0-38.4	46.3-49.3												
	1	50	11.1-11.5	12.5-12.8	15.4-15.9	17.0-17.5	18.6-19.2	22.2-22.8	24.1-24.8	26.0-25.8	30.2-31.1	32.4-33.3	34.6-35.7	44.4-45.8												
	1	100	10.8-10.8	12.1-12.1	14.9-14.9	16.5-16.5	18.1-18.1	21.5-21.5	23.3-23.3	25.2-25.2	29.3-29.3	31.4-31.4	33.6-33.6	43.2-53.2												
	2	10	11.9-15.2	13.3-17.0	16.5-21.0	18.2-23.2	19.9-25.5	23.7-30.3	25.7-32.9	27.8-35.6	32.3-41.2	34.6-44.2	37.0-47.3	47.6-60.8												
	2	20	11.6-14.5	13.0-16.3	16.0-20.1	17.6-22.2	19.4-24.3	23.0-29.0	25.0-31.4	27.0-34.0	31.4-39.4	33.7-42.3	36.0-45.3	46.3-58.1												
	2	50	11.1-13.7	12.5-15.3	15.4-18.9	17.0-20.8	18.6-22.9	22.2-27.2	24.1-29.5	26.0-32.0	30.2-37.1	32.4-39.8	34.6-42.5	44.5-54.6												
	2	100	10.8-13.0	12.1-14.6	14.9-18.0	16.5-19.8	18.1-21.8	21.5-25.9	23.3-28.1	25.2-30.4	29.3-35.3	31.4-37.8	33.6-40.5	43.2-52.0												
	3	10	11.9-15.2	13.3-17.0	16.5-21.0	18.2-23.2	19.9-25.5	23.7-30.3	25.7-32.9	27.8-35.6	32.3-41.2	34.6-44.2	37.0-47.3	47.6-60.8												
	3	20	11.6-14.5	13.0-16.3	16.0-20.1	17.6-22.2	19.4-24.3	23.0-29.0	25.0-31.4	27.0-34.0	31.4-39.4	33.7-42.3	36.0-45.3	46.3-58.1												
	3	50	11.1-13.7	12.5-15.3	15.4-18.9	17.0-20.8	18.6-22.9	22.2-27.2	24.1-29.5	26.0-32.0	30.2-37.1	32.4-39.8	34.6-42.5	44.5-54.5												
	3	100	10.8-13.0	12.1-14.8	14.9-18.0	16.5-19.8	18.1-21.8	21.5-25.9	23.3-28.1	25.2-30.4	29.3-35.3	31.4-37.8	33.6-40.5	43.2-52.0												
Wall	4	10	13.0-14.1	14.6-15.8	18.0-19.5	19.8-21.5	21.8-23.6	25.9-28.1	28.1-30.5	30.4-33.0	35.3-38.2	37.8-41.0	40.5-43.9	52.0-56.4												
	4	20	12.4-13.5	13.9-15.1	17.2-18.7	18.9-20.6	20.8-22.6	24.7-26.9	26.8-29.2	29.0-31.6	33.7-36.7	36.1-39.3	38.7-42.1	49.6-54.1												
	4	50	11.6-12.7	13.0-14.3	16.1-17.6	17.8-19.4	19.5-21.3	23.2-25.4	25.2-27.5	27.2-29.8	31.6-34.3	33.9-37.1	36.2-39.7	46.6-51.0												
	4	100	11.1-12.2	12.4-13.6	15.3-16.8	16.9-18.5	18.5-20.4	22.0-24.2	23.9-26.3	25.9-28.4	30.0-33.0	32.2-35.4	34.4-37.8	44.2-48.6												
	5	10	13.0-17.4	14.6-19.5	18.0-24.1	19.8-26.6	21.8-29.1	25.9-34.7	28.1-37.6	30.4-40.7	35.3-47.2	37.8-50.6	40.5-54.2	52.0-69.6												
	5	20	12.4-16.2	13.9-18.2	17.2-22.5	18.9-24.8	20.8-27.2	24.7-32.4	26.8-35.1	29.0-38.0	33.7-44.0	36.1-47.2	38.7-50.5	49.6-54.9												
	5	50	11.6-14.7	13.0-16.5	16.1-20.3	17.8-22.4	19.5-24.6	23.2-29.3	25.2-31.8	27.2-34.3	31.6-39.8	33.9-42.7	36.2-45.7	46.6-58.7												
	5	100	11.1-13.5	12.4-15.1	15.3-18.7	16.9-21.6	18.5-22.6	22.0-26.9	23.9-29.2	25.9-31.6	30.0-36.7	32.2-38.2	34.4-42.1	44.2-54.1												

For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929 m², 1 mile per hour = 1.609 km/h.

NOTES: For effective areas between those given above the load may be interpolated, otherwise use the load associated with the lower effective area. Table values shall be adjusted for height and exposure by multiplying by the adjustment coefficient in 780 CMR Table 5301.2(3).

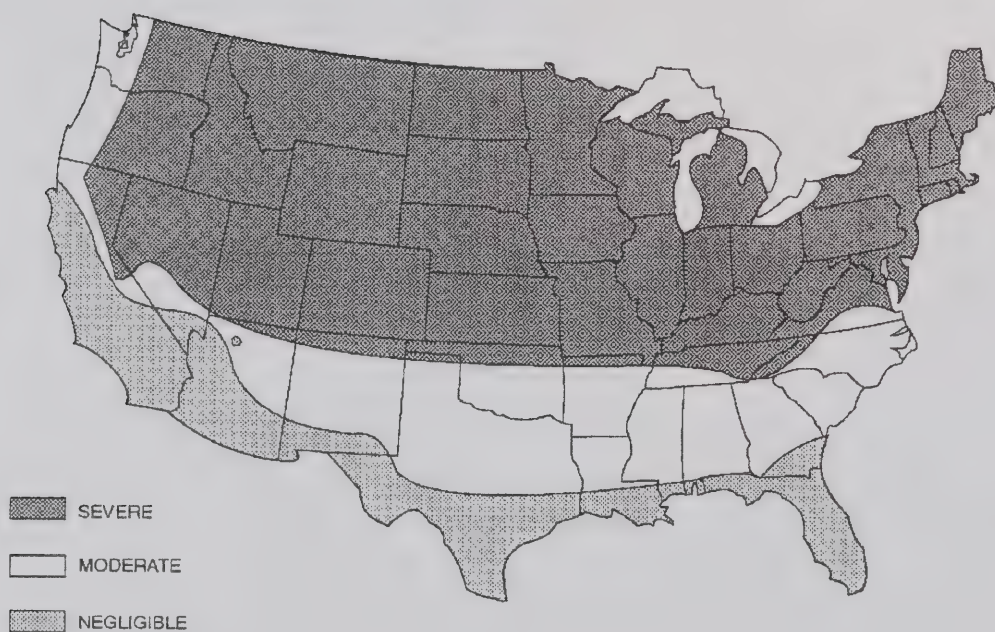
See Figure 780 CMR 5301.2(8) for location of zones.

Plus and minus signs signify pressures acting toward and away from the building surfaces.

780 CMR TABLE 5301.2(3)
HEIGHT AND EXPOSURE ADJUSTMENT COEFFICIENTS FOR TABLE 5301.2(2)

MEAN ROOF HEIGHT	EXPOSURE		
	B	C	D
15	1.00	1.21	1.47
20	1.00	1.29	1.55
25	1.00	1.35	1.61
30	1.00	1.40	1.66
35	1.05	1.45	1.70
40	1.09	1.49	1.74
45	1.12	1.53	1.78
50	1.16	1.56	1.81
55	1.19	1.59	1.84
60	1.22	1.62	1.87

780 CMR [B] FIGURE 5301.2(3)
WEATHERING PROBABILITY MAP FOR CONCRETE



- Alaska and Hawaii are classified as severe and negligible, respectively.
- Lines defining areas are approximate only. Local conditions may be more or less severe than indicated by region classification. A severe classification is where weather conditions result in significant snowfall combined with extended periods during which there is little or no natural thawing causing deicing salts to be used extensively.

BUILDING PLANNING FOR SINGLE- AND TWO-FAMILY DWELLINGS

TABLE 5301.2(4) MASSACHUSETTS BASIC WIND SPEEDS

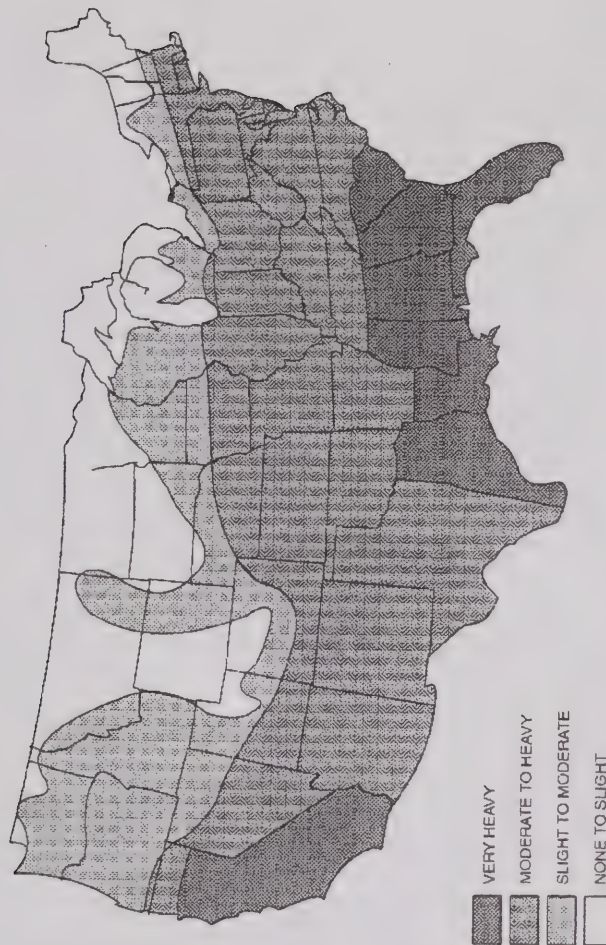
<90 MPH	90 MPH		100 MPH		110 MPH
Adams	Acton	New Braintree	Abington	Middleton	Acushnet
Alford	Agawam	New Marlborough	Amesbury	Milford	Aquinnah
Ashfield	Amherst	New Salem	Andover	Millis	Barnstable
Becket	Ashburnham	North Brookfield	Arlington	Millville	Bourne
Bernardston	Ashby	Northampton	Ashland	Milton	Brewster
Buckland	Athol	Northborough	Attleboro	Nahant	Carver
Cheshire	Auburn	Northfield	Avon	Natick	Chatham
Clarksburg	Ayer	Oakham	Bedford	Needham	Chillmark
Colrain	Barre	Orange	Bellingham	Newbury	Dartmouth
Cummington	Belchertown	Otis	Belmont	Newburyport	Dennis
Dalton	Berlin	Palmer	Berkley	Newton	Duxbury
Egremont	Blandford	Paxton	Beverly	Norfolk	Eastham
Florida	Bolton	Pelham	Billerica	North Andover	Edgartown
Great Barrington	Boxborough	Pepperell	Blackstone	North Attleborough	Fairhaven
Greenfield	Boylston	Petersham	Boston	North Reading	Fall River
Hancock	Brimfield	Phillipston	Boxford	Northbridge	Falmouth
Hawley	Brookfield	Princeton	Braintree	Norton	Freetown
Heath	Carlisle	Royalston	Bridgewater	Norwell	Gay Head
Hinsdale	Charlton	Russell	Brockton	Norwood	Gosnold
Lanesborough	Chelmsford	Rutland	Brookline	Oxford	Halifax
Lee	Chester	Sandisfield	Burlington	Peabody	Harwich
Lenox	Chesterfield	Shirley	Cambridge	Plainville	Kingston
Leyden	Chicopee	Shrewsbury	Canton	Quincy	Lakeville
Middlefield	Clinton	Shutesbury	Chelsea	Randolph	Marion
Monroe	Conway	South Hadley	Cohasset	Raynham	Marshfield
Monterey	Deerfield	Southampton	Concord	Reading	Mashpee
Mount Washington	Dracut	Southbridge	Danvers	Rehoboth	Mattapoisett
New Ashford	Dunstable	Southwick	Dedham	Revere	Middleborough
North Adams	East Brookfield	Spencer	Dighton	Rockland	Nantucket
Peru	East Longmeadow	Springfield	Douglas	Rockport	New Bedford
Pittsfield	Easthampton	Sterling	Dover	Rowley	Oak Bluffs
Plainfield	Erving	Stow	Dudley	Salem	Orleans
Richmond	Fitchburg	Sturbridge	East Bridgewater	Salisbury	Pembroke
Rowe	Gardner	Sunderland	Easton	Saugus	Plymouth
Savoy	Gill	Templeton	Essex	Seekonk	Plympton
Sheffield	Goshen	Tolland	Everett	Sharon	Provincetown
Shelburne	Granby	Townsend	Foxborough	Sherborn	Rochester
Stockbridge	Granville	Tyngsborough	Framingham	Somerville	Sandwich
Tyringham	Groton	Wales	Franklin	Southborough	Scituate
Washington	Hadley	Ware	Georgetown	Stoneham	Somerset
West Stockbridge	Hampden	Warren	Gloucester	Stoughton	Swansea
Williamstown	Hardwick	Warwick	Grafton	Sudbury	Tisbury
Windsor	Harfield	Wendell	Groveland	Sutton	Truro
Worthington	Harvard	West Boylston	Hamilton	Swampscott	Wareham
	Holden	West Brookfield	Hanover	Taunton	Welfleet
	Holland	West Springfield	Hanson	Tewksbury	West Tisbury
	Holyoke	Westfield	Haverhill	Topsfield	Westport
	Hubbardston	Westford	Hingham	Upton	Yarmouth
	Hudson	Westhampton	Holbrook	Uxbridge	
	Huntington	Westminster	Holliston	Wakefield	
	Lancaster	Whately	mm	Walpole	
	Lawrence	Wilbraham	Hopkington	Waltham	
	Leicester	Williamsburg	Hull	Watertown	
	Leominster	Winchendon	Ipswich	Wayland	
	Leverett	Worcester	Lexington	Webster	
	Littleton		Lincoln	Wellesley	
	Longmeadow		Lynn	Wenham	
	Lowell		Lynnfield	West Bridgewater	
	Ludlow		Malden	West Newbury	
	Lunenburg		Manchester	Westborough	
	Maynard		Mansfield	Weston	
	Methuen		Marblehead	Westwood	
	Millbury		Marlborough	Weymouth	
	Monson		Medfield	Whitman	
	Montague		Medford	Willmington	
	Montgomery		Medway	Winchester	
			Melrose	Winthrop	
			Mendon	Woburn	
			Merrimac	Wrentham	

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TABLE 5301.2(5) MASSACHUSETTS GROUND SNOW LOADS

25 PSF	35 PSF	40 PSF	40 PSF	50 PSF
Brewster	Abington	Alford	Nahant	Acton
Carver	Agawam	Arlington	Natick	Adams
Chatham	Amherst	Ashland	Needham	Amesbury
Eastham	Avon	Belmont	New Braintree	Andover
Harwich	Belchertown	Bellingham	New Marlborough	Ashburnham
Martha's Vineyard	Braintree	Beverly	New Salem	Ashby
Nantucket	Brockton	Blackstone	Newton	Ashfield
Orleans	Chicopee	Blandford	Norfolk	Athol
Plymouth	Cohasset	Boston	North Brookfield	Auburn
Provincetown	East Longmeadow	Brimfield	Northampton	Ayer
Truro	Easton	Brookfield	Northbridge	Barre
Wareham	Foxborough	Brookline	Norwood	Becket
Weilfleet	Granby	Cambridge	Peabody	Bedford
	Hadley	Canton	Pelham	Berlin
	Hampden	Charlton	Quincy	Bernardston
	Hingham	Chelsea	Revere	BillERICA
	Holbrook	Dedham	Russell	Bolton
	Holyoke	Douglas	Salem	Boxborough
	Hull	Dover	Saugus	Boxford
	Longmeadow	Dudley	Sheffield	Boylston
	Ludlow	East Brookfield	Sherborn	Buckland
	Mansfield	Easthampton	Shutesbury	Burlington
	Monson	Egremont	Somerville	Carlisle
	North Attleborough	Everett	Southampton	Charlemont
	Norwell	Framingham	Southborough	Chelmsford
	Palmer	Franklin	Southbridge	Cheshire
	Plainville	Grafton	Stoneham	Chester
	Randolph	Granville	Sturbridge	Chesterfield
	Rockland	Great Barrington	Sudbury	Clarksburg
	Scituate	Hardwick	Sunderland	Clinton
	Sharon	Hatfield	Sutton	Colrain
	South Hadley	Holland	Swampscott	Concord
	Southwick	Holliston	Tolland	Conway
	Springfield	Hopedale	Upton	Cummington
	Stoughton	Hopkington	Uxbridge	Dalton
	West Springfield	Leverett	Wakefield	Danvers
	Westfield	Lexington	Wales	Deerfield
	Weymouth	Lincoln	Walpole	Dracut
	Wilbraham	Lynn	Waltham	Dunstable
		Lynnfield	Ware	Erving
		Malden	Warren	Essex
		Manchester	Washington	Fitchburg
		Marblehead	Watertown	Florida
		Marlborough	Wayland	Gardner
		Medfield	Webster	Georgetown
		Medford	Wellesley	Gill
		Medway	West Brookfield	Gloucester
		Melrose	Westborough	
		Mendon	Westhampton	
		Middleton	Weston	
		Milford	Westwood	
		Millis	Whately	
		Millville	Winchester	
		Milton	Winthrop	
		Montgomery	Woburn	
		Mount Washington	Worcester	
			Wrentham	

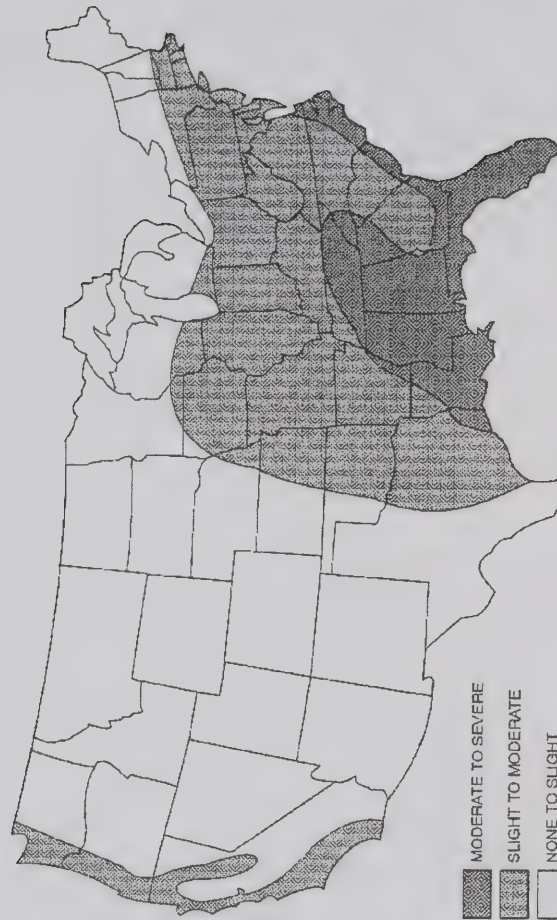
780 CMR FIGURE 5301.2(6)
TERMITE INFESTATION PROBABILITY MAP



NOTE: Lines defining areas are approximate only. Local conditions may be more or less severe than indicated by the region classification.

FIGURE 5301.2(6)
TERMITE INFESTATION PROBABILITY MAP

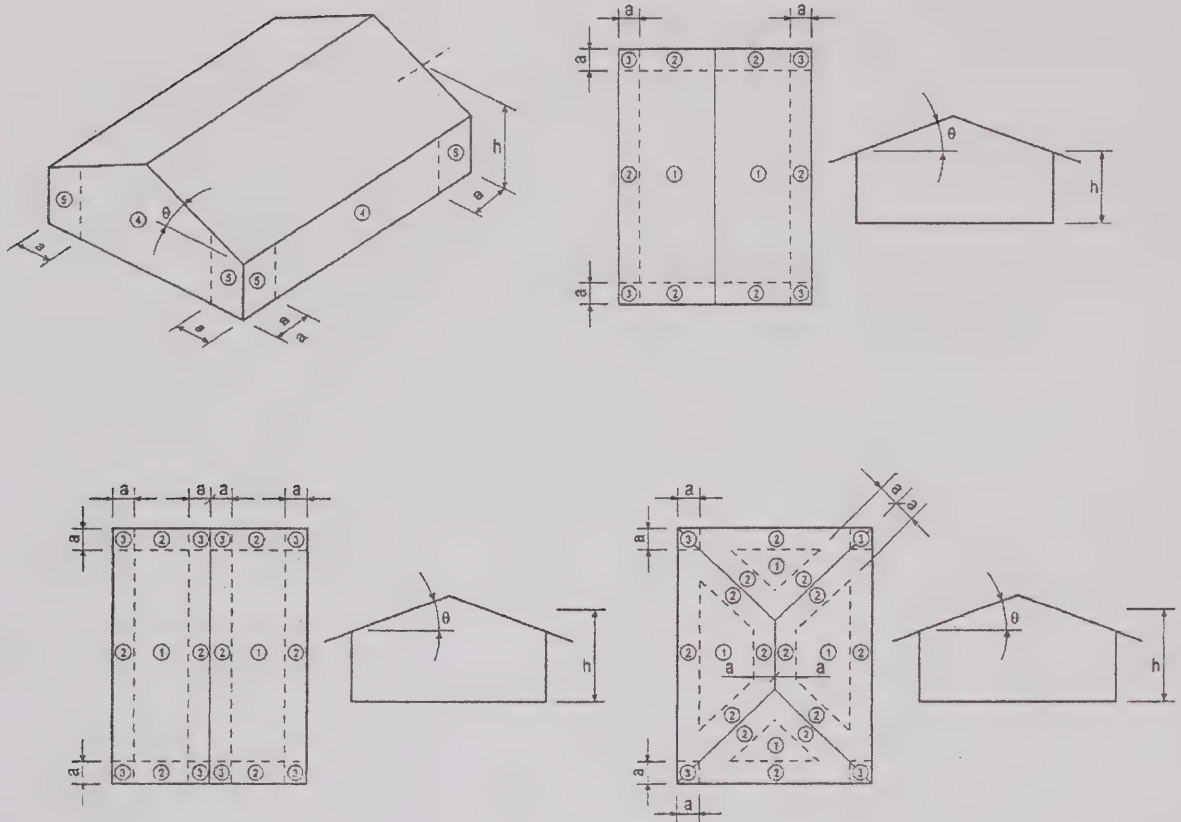
**780 CMR FIGURE 5301.2(7)
DECAY PROBABILITY MAP**



NOTES: Lines defining areas are approximate only. Local conditions may be more or less severe than indicated by the region classification.

**FIGURE 5301.2(7)
DECAY PROBABILITY MAP**

780 FIGURE 5301.2(8)
COMPONENT AND CLADDING PRESSURE ZONES



For SI: 1 foot = 304.8 mm, 1 degree = 0.009 rad.
NOTE: a = 4 feet in all cases

Exception: Wood structural panels with a minimum thickness of $\frac{7}{16}$ inch (11.1 mm) and a maximum span of eight feet (2438 mm) shall be permitted for opening protection in one- and two-story buildings. Panels shall be precut to cover the glazed openings with attachment hardware provided. Attachments shall be provided in accordance with 780 CMR Table 5301.2.1.2 or shall be designed to resist the components and cladding loads determined in accordance with the provisions of the *International Building Code* but utilizing the wind loads set forth in 780 CMR 53.00.

780 CMR TABLE 5301.2.1.2
WINDBORNE DEBRIS PROTECTION
FASTENING SCHEDULE FOR WOOD
STRUCTURAL PANELS^{a,b,c}

FASTENER TYPE	FASTENER SPACING		
	Panel span ≤ 4 foot	4 foot <panel span ≤ 6 foot	6 foot <panel span ≤ 8 foot
2½" # 6 Wood screws	16"	12"	9"
2½" # 8 Wood screws	16"	16"	12"

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound = 0.454 kg, 1 mile per hour = 1.609 km/h.

- This table is based on 130 mph wind speeds and a 33-foot mean roof height.
- Fasteners shall be installed at opposing ends of the wood structural panel.
- Where screws are attached to masonry or masonry/stucco, they shall be attached utilizing vibration-resistant anchors having a minimum ultimate resistant anchors having a minimum ultimate withdrawal capacity of 490 pounds.

5301.2.1.3 Wind Speed Conversion. When referenced documents are based on fastest mile wind speeds, the three second gust wind velocities of 780 CMR Table 5301.2(4) shall be converted to fastest mile wind velocities using 780 CMR Table 5301.2.1.3.

5301.2.1.4 Exposure Category. For each wind direction considered, an exposure category that adequately reflects the characteristics of ground surface irregularities shall be determined for the site at which the building or structure is to be constructed. For a site located in the transition zone between categories, the category resulting in the largest wind forces shall apply. Account shall be taken of variations in ground surface roughness

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that arise from natural topography and vegetation as well as from constructed features. For any given wind direction, the exposure in which a specific building or other structure is sited shall be assessed as being one of the following categories:

1. **Exposure A.** Large city centers with at least 50% of the buildings having a height in excess of 70 feet (21 336mm). Use of this exposure category shall be limited to those areas for which terrain representative of Exposure A prevails in the upwind direction for a distance of at least 0.5 mile (0.8 km) or ten times the height of the building or other structure, whichever is greater. Possible channeling effects or increased velocity pressures due to the building or structure being located in the wake of adjacent buildings shall be taken into account.
2. **Exposure B.** Urban and suburban areas, wooded areas, or other terrain with numerous closely spaced obstructions having the size of single-family dwellings or larger. Exposure B shall be assumed unless the site meets the definition of another type exposure.
3. **Exposure C.** Open terrain with scattered obstructions, including surface undulations or other irregularities, having heights generally less than 30 feet (9144 mm) extending more than 1,500 feet (457 m) from the building site in any quadrant. This exposure shall also apply to any building located within Exposure B type terrain where the building is directly adjacent to open areas of Exposure C type terrain in any quadrant for a distance of more than 600 feet (183 m). This category includes flat open country, grasslands and shorelines in hurricane prone regions.
4. **Exposure D.** Flat, unobstructed areas exposed to wind flowing over open water (excluding shorelines in hurricane prone regions) for a distance of at least one mile (1.61 km). Shore-lines in Exposure D include inland waterways, the Great Lakes and coastal areas of California, Oregon, Washington and Alaska. This exposure shall apply only to those buildings and other structures exposed to the wind coming from over the water. Exposure D extends inland from the shore-line a distance of 1,500 feet (457 m) or ten times the height of the building or structure, whichever is greater.

5301.2.2 Seismic Provisions. *Reserved.*

5301.2.3 Snow Loads. Wood framed construction, cold-formed steel framed construction and masonry and concrete construction in regions with ground snow loads 70 psf (3.35 kN/m²) or less, shall be in accordance with Chapters 55, 56 and 58. Buildings in regions with ground snow loads

greater than 70 psf (3.35 kN/m²) shall be designed in accordance with accepted engineering practice.

5301.2.4 Floodplain Construction. Buildings and structures constructed in flood hazard areas (including A or V Zones) as established by *FEMA Flood Insurance Rate Maps* shall be designed and constructed in accordance with 780 CMR 5323.

5301.3 Story Height. Buildings constructed in accordance with these provisions shall be limited to story heights of not more than the following:

1. For wood wall framing, the laterally unsupported bearing wall stud height permitted by 780 CMR Table 5602.3(5) plus a height of floor framing not to exceed 16 inches.

Exception: For wood framed wall buildings with bracing in accordance with 780 CMR Table 5602.10.1, the wall stud clear height used to determine the maximum permitted story height may be increased to 12 feet without requiring an engineered design for the building wind force resisting systems provided that the length of bracing required by 780 CMR Table 5602.10.1 is increased by multiplying by a factor of 1.20. Wall studs are still subject to the requirements of 780 CMR 5301.

2. For steel wall framing, a stud height of ten feet, plus a height of floor framing not to exceed 16 inches.

3. For masonry walls, a maximum bearing wall clear height of 12 feet plus a height of floor framing not to exceed 16 inches.

Exception: An additional eight feet is permitted for gable end walls.

4. For insulating concrete form walls, the maximum bearing wall height per story as permitted by 780 CMR 5611 tables plus a height of floor framing not to exceed 16 inches.

Individual walls or walls studs shall be permitted to exceed these limits as permitted by 780 CMR 56.00 provisions, provided story heights are not exceeded. An engineered design, *provided by a Massachusetts-registered professional engineer or architect* shall be provided for the wall or wall framing members when they exceed the limits of 780 CMR 56.00. Where the story height limits are exceeded, an engineered design shall be provided *addressing* the overall wind force resisting systems *and utilizing the wind loads of 780 CMR 51.00 through 99.00.*

5301.4 Dead Load. The actual weights of materials and construction shall be used for determining dead load with consideration for the dead load of fixed service equipment.

5301.5 Live Load. The minimum uniformly distributed live load shall be as provided in 780 CMR Table 5301.5.

780 CMR TABLE 5301.2.1.3
EQUIVALENT BASIC WIND SPEEDS^a

3-second gust	85	90	100	105	110	120	125	130	140	145	150	160	170
Fastest mile	70	75	80	85	90	100	105	110	120	125	130	140	150

For SI: 1 mile per hour = 1.609 km/h.

a. Linear interpolation is permitted

5301.6 Roof Load. Roof shall be designed for the live load indicated in 780 CMR Table 5301.6 or the snow load *based on the Massachusetts Ground Snow Load 780 CMR Table 5301.2(5)*, whichever is greater.

5301.7 Deflection. The allowable deflection of any structural member under the live load listed in 780 CMR 5301.5 and 5301.6 shall not exceed the values in 780 CMR Table 5301.7.

780 CMR TABLE 5301.5
MINIMUM UNIFORMLY DISTRIBUTED
LIVE LOADS
(in pounds per square foot)

USE	LIVE LOAD
Attics with storage ^b	20
Attics without storage ^b	10
Decks ^c	40
Exterior balconies	60
Fire escapes	40
Guardrails and handrails ^d	200
Guardrails in-fill components ^f	50
Passenger vehicle garages ^a	50 ^a
Rooms other than sleeping rooms	40
Sleeping rooms	30
Stairs	40 ^e

For SI: 1 pound per square foot = 0.0479 kN/m², 1 square inch = 645 mm², 1 pound = 4.45 N.

- Elevated garage floors shall be capable of supporting a 2,000-pound load applied over a 20-square-inch area.
- No storage with roof slope not over three units in 12 units.
- Individual stair treads shall be designed for the uniformly distributed live load or a 300-pound concentrated load acting over an area of four square inches, whichever produces the greater stresses.
- A single concentrated load applied in any direction at any point along the top.
- See 780 CMR 5502.2.1 for decks attached to exterior walls.
- Guard in-fill components (all those except the handrail), balusters and panel fillers shall be designed to withstand a horizontally applied normal load of 50 pounds on an area equal to one square foot. This load need not be assumed to act concurrently with any other live load requirement.

780 CMR TABLE 5301.6
MINIMUM ROOF LIVE LOADS IN
POUNDS-FORCE PER SQUARE FOOT OF
HORIZONTAL PROJECTION

ROOF SLOPE	TRIBUTARY LOADED AREA IN SQUARE FEET FOR ANY STRUCTURAL MEMBER		
	0 to 200	201 to 600	Over 600
Flat or rise less than 4 inches per foot (1:3)	20	16	12
Rise 4 inches per foot (1:3) to less than 12 inches per foot (1:1)	16	14	12
Rise 12 inches per foot (1:1) and greater	12	12	12

For SI: 1 square foot = 0.0929 m², 1 pound per square foot = 0.0479 kN/m², 1 inch per foot = 0.0833 mm/m.

780 CMR TABLE 5301.7
ALLOWABLE DEFLECTION OF
STRUCTURAL MEMBERS^{a,b,c}

STRUCTURAL MEMBER	ALLOWABLE DEFLECTION
Rafters having slopes greater than 3/12 with no finished ceiling attached to rafters	L/180
Interior walls and partitions	H/180
Floors and plastered ceilings	L/360
All other structural members	L/240
Exterior walls with plaster or stucco finish	H/360
Exterior walls—wind loads ^a with brittle finishes	L/240
Exterior walls—wind loads ^a with flexible finishes	L/120

Note: L = span length, H = span height.

- The wind load shall be permitted to be taken as 0.7 times the Component and Cladding loads for the purpose of the determining deflection limits herein.
- For cantilever members, L shall be taken as twice the length of the cantilever.
- For aluminum structural members or panels used in roofs or walls of sun-room additions or patio covers, not supporting edge of glass or sandwich panels, the total load deflection shall not exceed L/60. For sandwich panels used in roofs or walls of sunroom additions or patio covers, the total load deflection shall not exceed L/120.

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5301.8 Nominal Sizes. For the purposes of 780 CMR 51.00 through 99.00, where dimensions of lumber are specified, they shall be deemed to be nominal dimensions unless specifically designated as actual dimensions.

780 CMR 5302 LOCATION ON LOT

5302.1 Exterior Walls. Exterior walls with a fire separation distance less than three feet (914 mm) shall have not less than a one-hour fire-resistive rating with exposure from both sides. Projections shall not extend to a point closer than two feet (610 mm) from the line used to determine the fire separation distance.

Exception: Detached garages accessory to a dwelling located within two feet of a lot line may have roof eave projections not exceeding four inches *unless precluded by zoning bylaws*.

Projections extending into the fire separation distance shall have not less than one-hour fire-resistive construction on the underside. The above provisions shall not apply to walls which are perpendicular to the line used to determine the fire separation distance.

Exception: Tool and storage sheds, playhouses and similar structures exempted from permits by 780 CMR 5105.2 are not required to provide wall protection based on location on the lot. Projections beyond the exterior wall shall not extend over the lot line *or otherwise conflict with zoning bylaw requirements*.

5302.2 Openings. Openings shall not be permitted in the exterior wall of a dwelling or accessory building with a fire separation distance less than three feet (914 mm). This distance shall be measured perpendicular to the line used to determine the fire separation distance.

Exceptions:

1. Openings shall be permitted in walls that are perpendicular to the line used to determine the fire separation distance.
2. Foundation vents installed in compliance with 780 CMR 51.00 through 99.00 are permitted.

5302.3 Penetrations. Penetrations located in the exterior wall of a dwelling with a fire separation distance less than three feet (914 mm) shall be protected in accordance with 780 CMR 5317.3.

Exception: Penetrations shall be permitted in walls that are perpendicular to the line used to determine the fire separation distance.

780 CMR 5303 LIGHT, VENTILATION AND HEATING

5303.1 Habitable Rooms. All habitable rooms shall be provided with aggregate glazing area of not less

than 8% of the floor area of such rooms. Natural ventilation shall be through windows, doors, louvers or other approved openings to the outdoor air. Such openings shall be provided with ready access or shall otherwise be readily controllable by the building occupants. The minimum openable area to the outdoors shall be 4% of the floor area being ventilated.

Exceptions:

1. The glazed areas need not be openable where the opening is not required by 780 CMR 5310 and an approved mechanical ventilation system is provided capable of producing 0.35 air change per hour in the room or a whole-house mechanical ventilation system is installed capable of supplying outdoor ventilation air of 15 cubic feet per minute (cfm) (7.08 L/s) per occupant computed on the basis of two occupants for the first bedroom and one occupant for each additional bedroom.
2. The glazed areas need not be provided in rooms where 780 CMR 5303.1 Exception 1 is satisfied and artificial light is provided capable of producing an average illumination of six footcandles (6.46 lux) over the area of the room at a height of 30 inches (762 mm) above the floor level.

5303.2 Adjoining Rooms. For the purpose of determining light and ventilation requirements, any room shall be considered as a portion of an adjoining room when at least $\frac{1}{2}$ of the area of the common wall is open and unobstructed and provides an opening of not less than $\frac{1}{10}$ of the floor area of the interior room but not less than 25 square feet (2.32 m²).

Exception: Openings required for light and/or ventilation shall be permitted to open into a thermally isolated sunroom addition or patio cover, provided that there is an openable area between the adjoining room and the sunroom addition or patio cover of not less than $\frac{1}{10}$ of the floor area of the interior room but not less than 20 square feet (1.86 m²). The minimum openable area to the outdoors shall be based upon the total floor area being ventilated.

5303.3 Bathrooms. Bathrooms, water closet compartments and other similar rooms shall be provided with aggregate glazing area in windows of not less than three square feet (0.279 m²), $\frac{1}{2}$ of which must be openable.

Exception: The glazed areas shall not be required where artificial light and a mechanical ventilation system are provided. The minimum ventilation rates shall be 50 cfm (23.6 L/s) for intermittent ventilation or 20 cfm (9.4 L/s) for continuous ventilation. Ventilation air from the space shall be exhausted directly to the outside.

Notes: Mechanical ventilation of bathrooms containing a shower or bathtub is required at the ventilation rates noted in 780 CMR 5303.3 Exception.

Exhaust fans are not required by 780 CMR 51.00 through 99.00 in half-bathrooms. (For the purposes of 780 CMR 5303, half-bathrooms are defined as those bathrooms that contain only a toilet and sink.)

Massachusetts State Sanitary Code 105 CMR and/or Massachusetts Fuel Gas and Plumbing Code 248 CMR may require exhaust fans.

5303.4 Opening Location. Outdoor intake and exhaust openings shall be located in accordance with 780 CMR 5303.4.1 and 5303.4.2.

5303.4.1 Intake Openings. Mechanical and gravity outdoor air intake openings shall be located a minimum of ten feet (3048 mm) from any hazardous or noxious contaminant, such as vents, chimneys, plumbing vents, streets, alleys, parking lots and loading docks, except as otherwise specified in 780 CMR 51.00 through 99.00. Where a source of contaminant is located within ten feet (3048 mm) of an intake opening, such opening shall be located a minimum of two feet (610 mm) below the contaminant source.

For the purpose 780 CMR 5303, the exhaust from dwelling unit toilet rooms, bathrooms and kitchens shall not be considered as hazardous or noxious.

5303.4.2 Exhaust Openings. Outside exhaust openings shall be located so as not to create a nuisance. Exhaust air shall not be directed onto walkways.

5303.5 Outside Opening Protection. Air exhaust and intake openings that terminate outdoors shall be protected with corrosion-resistant screens, louvers or grilles having a minimum opening size of ¼ inch (6.4 mm) and a maximum opening size of ½ inch (12.7 mm), in any dimension. Openings shall be protected against local weather conditions. Outdoor air exhaust and intake openings shall meet the provisions for exterior wall opening protectives in accordance with 780 CMR 51.00 through 99.00.

5303.6 Stairway Illumination. All interior and exterior stairways shall be provided with *an artificial light source* to illuminate the stairs, including the landings and treads.

Such artificial light source shall comply with all applicable requirements of 527 CMR 12.

5303.6.1 Light Activation. The control for activation of the required interior stairway lighting shall conform to the requirements of 527 CMR 12.

5303.7 Required Glazed Openings. Required glazed openings shall open directly onto a street or public alley, or a yard or court located on the same lot as the building.

5303.7.1 Roofed Porches. Required glazed openings may face into a roofed porch where the porch abuts a street, yard or court and the longer side of the porch is at least 65% open and unobstructed and the ceiling height is not less than seven feet (2134 mm).

5303.8 Required Heating. Refer to 105 CMR 410.000 when applicable to rental property.

780 CMR 5304 MINIMUM ROOM AREAS

5304.1 Minimum Area. Every dwelling unit shall have at least one habitable room that shall have not less than **150 square** feet of gross floor area.

5304.2 Other Rooms. Other habitable rooms shall have a floor area of not less than 70 square feet (6.5 m²).

Exception: Kitchens.

5304.3 Minimum Dimensions. Habitable rooms shall not be less than seven feet (2134 mm) in any horizontal dimension.

Exception: Kitchens.

5304.4 Height Effect on Room Area. Portions of a room with a sloping ceiling measuring less than five feet (1524 mm) or a furred ceiling measuring less than seven feet (2134 mm) from the finished floor to the finished ceiling shall not be considered as contributing to the minimum required habitable area for that room.

780 CMR 5305 CEILING HEIGHT

5305.1 Minimum Height. Habitable rooms, hallways, corridors, bathrooms, toilet rooms, laundry rooms and basements shall have a ceiling height of not less than seven feet (2134 mm). The required height shall be measured from the finish floor to the lowest projection from the ceiling.

Exceptions:

1. Beams and girders spaced not less than four feet (1219 mm) on center may project not more than six inches (152 mm) below the required ceiling height.
2. Ceilings in basements without habitable spaces may project to within six feet, eight inches (2032 mm) of the finished floor; and beams, girders, ducts or other obstructions may project to within six feet, four inches (1931 mm) of the finished floor.
3. Not more than 50% of the required floor area of a room or space is permitted to have a sloped ceiling less than seven feet (2134 mm) in height with no portion of the required floor area less than five feet (1524 mm) in height.
4. Bathrooms shall have a minimum ceiling height of six feet eight inches (2036 mm) over the fixture and at the front clearance area for fixtures.

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A shower or tub equipped with a showerhead shall have a minimum ceiling height of six feet eight inches (2036 mm) above a minimum area 30 inches (762 mm) by 30 inches (762 mm) at the showerhead.

780 CMR 5306 SANITATION AND ELECTRICAL REQUIREMENTS

(Where applicable, refer to 248 CMR and/or 310 CMR 15.00 Title 5 and/or 105 CMR Chapter V and/or 527 CMR 12).

5306.1 Toilet Facilities. Every dwelling unit shall be provided with a water closet, lavatory, and a bathtub or shower *conforming to the applicable requirements of 248 CMR (the Massachusetts Fuel Gas and Plumbing Code).*

5306.2 Kitchen. Each dwelling unit shall be provided with a kitchen area and every kitchen area shall be provided with a sink *conforming to the applicable requirements of 248 CMR (the Massachusetts Fuel Gas and Plumbing Code).*

5306.3 Sewage Disposal. All plumbing fixtures shall be connected to a sanitary sewer or to an approved private sewage disposal system.

5306.4 Water Supply to Fixtures. All plumbing fixtures shall be connected to an approved water supply. Kitchen sinks, lavatories, bathtubs, showers, bidets, laundry tubs and washing machine outlets shall be provided with hot and cold water; *all such requirements conforming to the applicable requirements of 248 CMR (the Massachusetts Fuel Gas and Plumbing Code).*

5306.5 Electrical Code. See 527 CMR 12.

780 CMR 5307 TOILET, BATH AND SHOWER SPACES

5307.1 Space Required. Fixtures shall be spaced as *required by the applicable requirements of 248 CMR (the Massachusetts Fuel Gas and Plumbing Code)*

5307.2 Bathtub and Shower Spaces. Bathtub and shower floors and walls above bathtubs with installed shower heads and in shower compartments shall be finished with a nonabsorbent surface. Such wall surfaces shall extend to a height of not less than six feet (1829 mm) above the floor (*also see 248 CMR*).

SECTION 5308 GLAZING

5308.1 Identification. Except as indicated in 780 CMR 5308.1.1, *and as required by CPSC 16 CFR (Code of Federal Regulations); 1201 and M.G.L. c. 143, §§ 3t, 3U and 3T*, each pane of glazing installed in hazardous locations as defined in 780 CMR 5308.4 shall be provided with a manufacturer's, *fabricator's* or installer's label, designating

the type and thickness of glass and the safety glazing standard with which it complies, which is visible in the final installation. The label shall be acid etched, sandblasted, ceramic-fired, embossed mark, or shall be of a type which once applied cannot be removed without being destroyed.

Note: also refer to 780 CMR 61.00 relative to the National Fenestration Rating Council (NFRC) listing.

Exceptions:

1. For other than tempered glass, labels may be omitted provided the building official approves the use of a certificate, affidavit or other evidence confirming compliance with 780 CMR 51.00 through 99.00.
2. Tempered spandrel glass may be identified by the manufacturer with a removable paper label.

5308.1.1 Identification of Multipane Assemblies. Multi-pane assemblies having individual panes not exceeding one square foot (0.09 m²) in exposed area shall have at least one pane in the assembly identified in accordance with 780 CMR 5308.1. All other panes in the assembly shall be labeled "16 CFR 1201."

5308.2 Louvered Windows or Jalousies. Regular, float, wired or patterned glass in jalousies and louvered windows shall be no thinner than nominal $\frac{3}{16}$ inch (4.76 mm) and no longer than 48 inches (1219 mm). Exposed glass edges shall be smooth.

5308.2.1 Wired Glass Prohibited. Wired glass with wire exposed on longitudinal edges shall not be used in jalousies or louvered windows.

5308.3 Human Impact Loads. Individual glazed areas including glass mirrors in hazardous locations such as those indicated as defined in 780 CMR 5308.4 shall pass the test requirements of CPSC 16 CFR, Part 1201. Glazing shall comply with the CPSC 16 CFR, Part 1201 criteria for Category I or Category II as indicated in 780 CMR Table 5308.3.

Exceptions:

1. Polished wired glass for use in fire doors and other fire resistant locations shall comply with ANSI Z97. 1.
2. Louvered windows and jalousies shall comply with 780 CMR 5308.2.

5308.4 Hazardous Locations. *The following locations, as established by M.G.L. c. 143, § 3T and as specified in 780 CMR 5308, shall be considered specific hazardous locations for the purposes of glazing:*

1. Glazing in swinging doors except jalousies.
2. Glazing in fixed and sliding panels of sliding door assemblies and panels in sliding and bifold closet door assemblies.
3. Glazing in storm doors.
4. Glazing in all unframed swinging doors.

780 CMR TABLE 5308.3
MINIMUM CATEGORY CLASSIFICATION OF GLAZING

EXPOSED SURFACE AREA OF ONE SIDE OF ONE LITE	GLAZING IN STORM OR COMBINATION DOORS (Category Class)	GLAZING IN DOORS (Category Class)	GLAZED PANELS REGULATED BY 780 CMR 5308.4.7. (Category Class)	GLAZED PANELS REGULATED BY 780 CMR 5308.4.6. (Category Class)	GLAZING IN DOORS AND ENCLOSURES REGULATED BY 780 CMR 5308.4.5. (Category Class)	SLIDING GLASS DOORS PATIO TYPE (Category Class)
9 sq. ft. or less	I	I	NR ^a	I	II	II
More than 9 sq. ft.	II	II	II	II	II	II

For SI: 1 square foot = 0.0929 m².

^aNR means "No Requirement."

5. Glazing in doors and enclosures for hot tubs, whirlpools, saunas, steam rooms, bathtubs and showers. Glazing in any part of a building wall enclosing these compartments where the bottom exposed edge of the glazing is less than 60 inches (1524 mm) measured vertically above any standing or walking surface.

6. Glazing, in an individual fixed or operable panel adjacent to a door where the nearest vertical edge is within a 24-inch (610 mm) arc of the door in a closed position and whose bottom edge is less than 60 inches (1524 mm) above the floor or walking surface.

7. Glazing in an individual fixed or operable panel, other than those locations described in 780 CMR 5308.4.5 and 6, that meets all of the following conditions:

- 7.1. Exposed area of an individual pane greater than nine square feet (0.836 m²).
- 7.2. Bottom edge less than 18 inches (457 mm) above the floor.
- 7.3. Top edge greater than 36 inches (914 mm) above the floor.
- 7.4. One or more walking surfaces within 36 inches (914 mm) horizontally of the glazing.

8. All glazing in railings regardless of an area or height above a walking surface. Included are structural baluster panels and nonstructural in-fill panels.

9. Glazing in walls and fences enclosing indoor and outdoor swimming pools, hot tubs and spas where the bottom edge of the glazing is less than 60 inches (1524 mm) above a walking surface and within 60 inches (1524 mm) horizontally of the water's edge. This shall apply to single glazing and all panes in multiple glazing.

10. Glazing adjacent to stairways, landings and ramps within 36 inches (914 mm) horizontally of a walking surface when the exposed surface of the glass is less than 60 inches (1524 mm) above the plane of the adjacent walking surface.

11. Glazing adjacent to stairways within 60 inches (1524 mm) horizontally of the bottom tread of a stairway in any direction when the exposed surface of the glass is less than 60 inches (1524 mm) above the nose of the tread.

12. Fixed glazed panels adjacent to entrance and exit doors which, because of their location, present a barrier in the normal path traveled by persons going into or out of these buildings, and because of their size and design may be mistaken as means of egress

Exception: The following products, materials and uses are exempt from the above hazardous locations:

1. Openings in doors through which a three-inch (76 mm) sphere is unable to pass.
2. Decorative glass in 780 CMR 5308.4.1., 6. or 7.
3. Glazing in 780 CMR 5308.4.6., when there is an intervening wall or other permanent barrier between the door and the glazing.
4. Glazing in 780 CMR 5308.4.6., in walls perpendicular to the plane of the door in a closed position or where access through the door is to a closet or storage area three feet (914 mm) or less in depth. Glazing in these applications shall comply with 780 CMR 5308.4.7.
5. Glazing in 780 CMR 5308.4.7. and 10., when a protective bar is installed on the accessible side(s) of the glazing 36 inches x two inches (914 mm x 51 mm) above the floor. The bar shall be capable of withstanding a horizontal load of 50 pounds per linear foot (74.5 kg/m) without contacting the glass and be a minimum of 1½ inches (38 mm) in height.
6. Outboard panes in insulating glass units and other multiple glazed panels in 780 CMR 5308.4.7., when the bottom edge of the glass is 25 feet (7620 mm) or more above grade, a roof, walking surface, or other horizontal [within 45 degrees (0.79 rad) of horizontal] surface adjacent to the glass exterior.
7. Louvered windows and жалюзи complying with the requirements of 780 CMR 5308.2.
8. Mirrors and other glass panels mounted or hung on a surface that provides a continuous backing support.

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9. Safety glazing in 780 CMR 5308.4.10. and 11. is not required where:

- 9.1. The side of a stairway, landing or ramp has a guardrail or handrail, including balusters or in-fill panels, complying with the provisions of 780 CMR 1003.3.12 and 1607.7 *Sixth Edition, Massachusetts Building Code*; and
- 9.2. The plane of the glass is greater than 18 inches (457 mm) from the railing.

5308.5 Site Built Windows. Site built windows shall comply with 780 CMR 2404 of the *Sixth Edition, Massachusetts State Building Code but utilizing the wind loads of 780 CMR 51.00 through 99.00; note that seismic design is not required.*

5308.6 Skylights and Sloped Glazing. Skylights and sloped glazing shall comply with 780 CMR 5308.6.1 through 5308.6.9.

5308.6.1 Definitions.

SKYLIGHTS AND SLOPED GLAZING.

Glass or other transparent or translucent glazing material installed at a slope of more than 15 degrees (0.26 rad) from vertical. Glazing materials in skylights, including unit skylights, solariums, sunrooms, roofs and sloped walls are included in this definition.

UNIT SKYLIGHT. A factory assembled, glazed fenestration unit, containing one panel of glazing material, that allows for natural daylighting through an opening in the roof assembly while preserving the weather resistant barrier of the roof.

5308.6.2 Permitted Materials. The following types of glazing may be used:

1. Laminated glass with a minimum 0.015-inch (0.38 mm) polyvinyl butyral interlayer for glass panes 16 square feet (1.5 m²) or less in area located such that the highest point of the glass is not more than 12 feet (3658 mm) above a walking surface or other accessible area; for higher or larger sizes, the minimum interlayer thickness shall be 0.030 inch (0.76 mm).
2. Fully tempered glass.
3. Heat-strengthened glass.
4. Wired glass.
5. Approved rigid plastics.

5308.6.3 Screens, General. For fully tempered or heat-strengthened glass, a retaining screen meeting the requirements of 780 CMR 5308.6.7 shall be installed below the glass, except for fully tempered glass that meets either condition listed in 780 CMR 5308.6.5.

5308.6.4 Screens with Multiple Glazing. When the inboard pane is fully tempered, heat-strengthened, or wired glass, a retaining screen meeting the requirements of 780 CMR 5308.6.7

shall be installed below the glass, except for either condition listed in 780 CMR 5308.6.5. All other panes in the multiple glazing may be of any type listed in 780 CMR 5308.6.2.

5308.6.5 Screens not Required. Screens shall not be required when fully tempered glass is used as single glazing or the inboard pane in multiple glazing and either of the following conditions are met:

1. Glass area 16 square feet (1.49 m²) or less. Highest point of glass not more than 12 feet (3658 mm) above a walking surface or other accessible area, nominal glass thickness not more than ³/₁₆ inch (4.76 mm), and (for multiple glazing only) the other pane or panes fully tempered, laminated or wired glass.
2. Glass area greater than 16 square feet (1.49 m²). Glass sloped 30 degrees (0.52 rad) or less from vertical, and highest point of glass not more than ten feet (3048 mm) above a walking surface or other accessible area.

5308.6.6 Glass in Greenhouses. Any glazing material is permitted to be installed without screening in the sloped areas of greenhouses, provided the greenhouse height at the ridge does not exceed 20 feet (6096 mm) above grade.

5308.6.7 Screen Characteristics. The screen and its fastenings shall be capable of supporting twice the weight of the glazing, be firmly and substantially fastened to the framing members, and have a mesh opening of no more than one inch by one inch (25.4 mm by 25.4 mm).

5308.6.8 Curbs for Skylights. All unit skylights installed in a roof with a pitch flatter than three units vertical in 12 units horizontal (25% slope) shall be mounted on a curb extending at least four inches (102 mm) above the plane of the roof unless otherwise specified in the manufacturer's installation instructions.

5308.6.9 Testing and Labeling. Unit skylights shall be tested by an approved independent laboratory, and bear a label identifying manufacturer, performance grade rating, and approved inspection agency to indicate compliance with the requirements of AAMA/WDMA 101/I.S.2/NAFS.

780 CMR 5309 GARAGES AND CARPORTS

5309.1 Opening Protection. Openings from a private garage directly into a room used for sleeping purposes shall not be permitted. Other openings between the garage and residence shall be equipped with solid wood doors not less than 1³/₈ inches (35 mm) in thickness, solid or honeycomb core steel doors not less than 1³/₈ inches (35 mm) thick, or 20-minute fire-rated doors.

All such panel doors shall be labeled with a minimum 20-minute fire-resistance rating.

Self-closing devices and fire-resistive-rated door frames are not required. All door openings between the garage floor and the dwelling shall be provided with a raised sill with a minimum height of four inches (102 mm).

5309.1.1 Duct Penetration. Ducts in the garage and ducts penetrating the walls or ceilings separating the dwelling from the garage shall be constructed of a minimum No. 26 gage (0.48 mm) sheet steel or other approved material and shall have no openings into the garage.

5309.2 Separation Required. The garage shall be separated from the residence and its attic area by not less than *5/8 inch Type X gypsum board or equivalent (15.9 mm)* gypsum board applied to the garage side. Garages beneath habitable rooms shall be separated from all habitable rooms above by not less than *5/8-inch (15.9 mm) Type X gypsum board or equivalent*. Where the separation is a floor-ceiling assembly, the structure supporting the separation shall also be protected by not less than *5/8-inch (15.9 mm) gypsum board or equivalent*.

5309.3 Floor Surface. Garage floor surfaces shall be of approved noncombustible material.

The area of floor used for parking of automobiles or other vehicles shall be sloped to facilitate the movement of liquids to a drain or toward the main vehicle entry doorway. *Concrete floors shall be installed as required by 780 CMR 5506.*

5309.4 Carports. Carports shall be open on at least two sides. Carport floor surfaces shall be of approved noncombustible material. Carports not open on at least two sides shall be considered a garage and shall comply with the provisions of 780 CMR 5309 for garages.

Exception: Asphalt surfaces shall be permitted at ground level in carports.

The area of floor used for parking of automobiles or other vehicles shall be sloped to facilitate the movement of liquids to a drain or toward the main vehicle entry doorway.

5309.5 Flood Hazard Areas. For buildings located in flood hazard areas as established by *the applicable FEMA Flood Insurance Rate Map(s)* garage floors shall be:

1. Elevated to or above the design flood elevation as determined in 780 CMR 5323; or
2. Located below the design flood elevation provided they are at or above grade on all sides, are used solely for parking, building access, or storage, meet the requirements of 780 CMR 5323, and are otherwise constructed in accordance with 780 CMR 51.00 through 99.00.

5309.6 Automatic Garage door Openers. Automatic garage door openers, if provided, shall be listed in accordance with UL 325.

780 CMR 5310 EMERGENCY ESCAPE AND RESCUE OPENINGS

5310.1 Emergency Escape and Rescue Required.

Basements with habitable space and every sleeping room shall have at least one openable emergency escape and rescue opening. Where basements contain one or more sleeping rooms, emergency egress and rescue openings shall be required in each sleeping room, but shall not be required in adjoining areas of the basement. Where emergency escape and rescue openings are provided they shall have a sill height of not more than 44 inches (1118 mm) above the floor. Where a door opening having a threshold below the adjacent ground elevation serves as an emergency escape and rescue opening and is provided with a bulkhead enclosure, the bulkhead enclosure shall comply with 780 CMR 5310.3. The net clear opening dimensions required by 780 CMR 5310 shall be obtained by the normal operation of the emergency escape and rescue opening from the inside. Emergency escape and rescue openings with a finished sill height below the adjacent ground elevation shall be provided with a window well in accordance with 780 CMR 5310.2.

5310.1.1 Minimum Opening Area. All emergency escape and rescue openings shall have a minimum net clear opening of 5.7 square feet (0.530 m²).

Exceptions:

1. *Grade floor openings shall have a minimum net clear opening of five square feet (0.465 m²).*
2. *Double hung windows used for emergency escape shall be permitted to have a net clear opening of 3.3 square feet (0.31 m²) provided that at least one operable sash meets the minimum height and width required by 780 CMR 5310.1.2 and 5310.1.3 and operational constraints defined by 780 CMR 5310.1.4.*

5310.1.2 Minimum Opening Height. The minimum net clear opening height shall be 24 inches (610 mm).

5310.1.3 Minimum Opening Width. The minimum net clear opening width shall be 20 inches (508 mm).

5310.1.4 Operational Constraints. Emergency escape and rescue openings shall be operational from the inside of the room without the use of keys or tools.

5310.2 Window Wells. The minimum horizontal area of the window well shall be nine square feet (0.84 m²), with a minimum horizontal projection and width of 36 inches (914 mm). The area of the window well shall allow the emergency escape and rescue opening to be fully opened.

Exception The ladder or steps required by 780 CMR 5310.2.1 shall be permitted to encroach

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a maximum of six inches (152 mm) into the required dimensions of the window well.

5310.2.1 Ladder and Steps. Window wells with a vertical depth greater than 44 inches (1118 mm) shall be equipped with a permanently affixed ladder or steps usable with the window in the fully open position. Ladders or steps required by 780 CMR 5310.2.1 shall not be required to comply with 780 CMR 5311.5 and 5311.6. Ladders or rungs shall have an inside width of at least 12 inches (305 mm), shall project at least three inches (76 mm) from the wall and shall be spaced not more than 18 inches (457 mm) on center vertically for the full height of the window well.

5310.3 Bulkhead Enclosures. Bulkhead enclosures shall provide direct access to the basement. The bulkhead enclosure with the door panels in the fully open position shall provide the minimum net clear opening required by 780 CMR 5310.1.1. Bulkhead enclosures shall also comply with 780 CMR 5311.5.8.2.

5310.4 Bars, Grills, Covers and Screens. Bars, grills, covers, screens or similar devices are permitted to be placed over emergency escape and rescue openings, bulkhead enclosures, or window wells that serve such openings, provided the minimum net clear opening size complies with 780 CMR 5310.1.1 through 5310.1.3, and such devices shall be releasable or removable from the inside without the use of a key, tool or force greater than that which is required for normal operation of the escape and rescue opening. *Also see 527 CMR as referenced in Appendix A.*

780 CMR 5311 MEANS OF EGRESS

5311.1 General. Stairways, ramps, exterior exit balconies, hallways and doors shall comply with 780 CMR 5311.

5311.2 Construction.

5311.2.1 Attachment. Required exterior exit balconies, stairs and similar exit facilities shall be positively anchored to the primary structure to resist both vertical and lateral forces. Such attachment shall not be accomplished by use of toenails or nails subject to withdrawal.

5311.2.2 Under Stair Protection. Enclosed accessible space under stairs shall have walls, under stair surface and any soffits protected on the enclosed side with ½-inch (12.7 mm) gypsum board.

5311.3 Hallways. The minimum width of a hallway shall be not less than three feet (914 mm).

5311.4 Doors.

5311.4.1 Exit Doors Required. *Egress from all dwelling units shall be by means of two exit doors, remote as possible from each other and leading directly to grade. Such doors*

shall be provided at the normal level of entry/exit. In addition, all other floors within a dwelling unit shall have at least one means by which a continuous and unobstructed path leads to the exit doors. Such continuous and unobstructed paths shall be by means of stairways, corridors, hallways or combinations thereof.

Exception 1: In split-level and raised ranch style layouts, the two separate exit doors required by 780 CMR 5311 are permitted to be located on different levels.

Exception 2: Where site topography prevents direct access at two remote locations to grade from the normal level of entry/exit, the two separate exit doors required by 780 CMR 5311.4.1 are permitted to be located on different levels.

5311.4.2 Exit Door Types and Sizes. *The minimum nominal width of at least one of the exit doors required by 780 CMR 5311.4 shall not be less than 36 inches (914 mm) in width and the minimum nominal height shall be 6 feet, eight inches (2032 mm). The 36-inch (914 mm) exit door shall be side-hinged. All other required exit doors and doors leading to or from enclosed stairways, or to interior vestibules shall not be less than 32 inches (813 mm) in nominal width or less than six feet, eight inches (2032 mm) in nominal height and maybe of the sliding or side-hinged type. The 36-inch (914 mm) required exit door shall provide for direct access from the habitable portions of the dwelling to the exterior without requiring travel through a garage. The 32-inch (813 mm) secondary exit door may provide egress through an attached garage, provided that the attached garage is also provided with a 32-inch (813 mm) exit door meeting the requirements of 780 CMR 5311. Side-hinged swinging doors provided to meet these requirements are permitted to swing inward.*

Other exterior doors, in excess of the two required exit doors, whether side-hinged or sliding-type doors, shall not be required to comply with these minimum dimensions.

5311.4.2.1 Interior Doors. *All doors providing access to habitable rooms shall have a minimum nominal width of 30 inches (762 mm) and a minimum nominal height of six feet, six inches (1981 mm).*

Exceptions:

- 1. Doors providing access to bathrooms are permitted to be 28 inches (711 mm) in nominal width.*
- 2. Doors providing access to bathrooms in existing buildings are permitted to be 24 inches (610 mm) in nominal width.*

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5311.4.3 Landings at Doors. There shall be a floor or landing on each side of each exterior door.

Exceptions:

1. Where a stairway of two or fewer risers is located on the exterior side of a door, other than the required exit door, a landing is not required for the exterior side of the door.

The floor or landing at the exit door required by 780 CMR 5311.4.1 shall not be more than 1½ inches (38 mm) lower than the top of the threshold. The floor or landing at exterior doors other than the exit door required by 780 CMR 5311.4.1 shall not be required to comply with this requirement but shall have a rise no greater than that permitted in 780 CMR 5311.5.3.

2. The landing at an exterior doorway shall not be more than 7¼ inches (196 mm) below the top of the threshold, provided the door, other than an exterior storm or screen door does not swing over the landing.

The width of each landing shall not be less than the door served. Every landing shall have a minimum dimension of 36 inches (914 mm) measured in the direction of travel.

5311.4.4 Type of Lock or Latch. All egress doors shall be readily openable from the side from which egress is to be made without the use of a key or special knowledge or effort.

5311.5 Stairways.

5311.5.1 Width. Stairways shall not be less than 36 inches (914 mm) in clear width at all points above the permitted handrail height and below the required headroom height. Handrails shall not project more than 4½ inches (114 mm) on either side of the stairway and the minimum clear width of the stairway at and below the handrail height, including treads and landings, shall not be less than 31½ inches (787 mm) where a handrail is installed on one side and 27 (698 mm) where handrails are provided on both sides.

Exception: The width of spiral stairways shall be in accordance with 780 CMR 5311.5.8.

5311.5.2 Headroom. The minimum headroom in all parts of the stairway shall not be less than six feet six inches (1981 mm) measured vertically from the sloped plane adjoining the tread nosing or from the floor surface of the landing or platform.

Exception: Minimum headroom under a sloped ceiling in an existing building shall be maintained for a minimum width of 36 inches (914 mm) as measured from the side of the stair with the continuous handrail.

5311.5.3 Stair treads and risers.

5311.5.3.1 Riser Height. The maximum riser height shall be 8¼ inches (210 mm). The riser shall be measured vertically between leading edges of the adjacent treads. The greatest riser height within any flight of stairs shall not exceed the smallest by more than ¾ inch (9.5 mm).

5311.5.3.2 Tread Depth. The minimum tread depth shall be nine inches (229 mm). The tread depth shall be measured horizontally between the vertical planes of the foremost projection of adjacent treads and at a right angle to the tread's leading edge. The greatest tread depth within any flight of stairs shall not exceed the smallest by more than ¾ inch (9.5 mm). Winder treads shall have a minimum tread depth equal to the tread depth of the straight run portion of the stairs measured as above at a point 12 inches (305 mm) from the side where the treads are narrower. Winder treads shall have a minimum tread depth of three inches (76 mm) at any point. Within any flight of stairs, the greatest winder tread depth at the 12 inch (305 mm) walk line shall not exceed the smallest by more than ¾ inch (9.5 mm).

Exception: 45 degree winders are allowed to go to a minimum of two inches (51 mm) at any point

5311.5.3.3 Profile. Nosings shall not project more than 1½ inches (38 mm) beyond the face of the riser below. Open risers are permitted, provided that the opening between treads does not permit the passage of a five-inch-diameter (127 mm) sphere.

Exceptions:

1. A nosing is not required where the tread depth is a minimum of 11 inches (279 mm).

2. The opening between adjacent treads is not limited on stairs with a total rise of 30 inches (762 mm) or less.

5311.5.4 Landings for Stairways. There shall be a floor or landing at the top and bottom of each stairway.

Exception A floor or landing is not required at the top of an interior flight of stairs, provided a door does not swing over the stairs.

A flight of stairs shall not have a vertical rise greater than 12 feet (3658 mm) between floor levels or landings.

The width of each landing shall not be less than the stairway served. Every landing shall have a minimum dimension of 36 inches (914 mm) measured in the direction of travel.

5311.5.5 Stairway Walking Surface. The walking surface of treads and landings of stairways shall be sloped no steeper than one unit

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vertical in 48 inches horizontal (2% slope).

5311.5.6 Handrails. Handrails shall be provided on at least one side of each continuous run of treads or flight with *three* or more risers.

5311.5.6.1 Height. Handrail height, measured vertically from the sloped plane adjoining the tread nosing, or finish surface of ramp slope, shall be not less than 34 inches (864 mm) and not more than 38 inches (965 mm).

5311.5.6.2 Continuity. Handrails for stairways shall be continuous for the full length of the flight, from a point directly above the top riser of the flight to a point directly above lowest riser of the flight. Handrail ends shall be returned or shall terminate in newel posts or safety terminals. Handrails adjacent to a wall shall have a space of not less than 1½ inch (38 mm) between the wall and the handrails.

Exceptions:

1. Handrails shall be permitted to be interrupted by a newel post at the turn.
2. The use of a volute, turnout, starting easing or starting newel shall be allowed over the lowest tread.

5311.5.6.3 Handrail Grip Size. All required handrails shall be of one of the following types or provide equivalent graspability.

1. **Type I.** Handrails with a circular cross section shall have an outside diameter of at least 1¼ inches (32 mm) and not greater than 2¼ inches (70 mm). If the handrail is not circular it shall have a perimeter dimension of at least four inches (102 mm) and not greater than 6¼ inches (160 mm) with a maximum cross section of dimension of 2¼ inches (57 mm).

2. **Type II.** Handrails with a perimeter greater than 6¼ inches (160 mm) shall provide a graspable finger recess area on both sides of the profile. The finger recess shall begin within a distance of ¾ inch (19 mm) measured vertically from the tallest portion of the profile and achieve a depth of at least ⅝ inch (8 mm) within ⅞ inch (22 mm) below the widest portion of the profile. This required depth shall continue for at least ¾ inch (10 mm) to a level that is not less than 1¾ inches (45 mm) below the tallest portion of the profile. The minimum width of the handrail above the recess shall be 1¼ inches (32 mm) to a maximum of 2¼ inches (70 mm). Edges shall have a minimum radius of 0.01 inches (0.25 mm).

5311.5.7 Illumination. All stairs shall be provided with illumination in accordance with 780 CMR 5303.6.

5311.5.8 Special Stairways. Circular stairways, spiral stairways, winders and bulkhead enclosure

stairways shall comply with all requirements of 780 CMR 5311.5 except as specified in 780 CMR 5311.5.8.1 and 5311.5.8.2.

5311.5.8.1 Spiral Stairways. Spiral stairways are permitted, provided the minimum width shall be 26 inches (660 mm) with each tread having a 7½-inches (190 mm) minimum tread depth at 12 inches from the narrower edge. All treads shall be identical, and the rise shall be no more than 9½ inches (241 mm). A minimum headroom of six feet six inches (1982 mm) shall be provided.

5311.5.8.2 Bulkhead Enclosure Stairways. Stairways serving bulkhead enclosures, not part of the required building egress, providing access from the outside grade level to the basement shall be exempt from the requirements of 780 CMR 5311.4.3 and 5311.5 where the maximum height from the basement finished floor level to grade adjacent to the stairway does not exceed eight feet (2438 mm), and the grade level opening to the stairway is covered by a bulkhead enclosure with hinged doors or other approved means.

5311.6 Ramps.

5311.6.1 Maximum Slope. Ramps *that are part of a means of egress and are attached to a dwelling unit* shall have a maximum slope of one unit vertical in eight units horizontal (12.5%).

5311.6.2 Landings Required. A minimum three-foot-by-three-foot (914 mm by 914 mm) landing shall be provided:

1. At the top and bottom of ramps,
2. Where doors open onto ramps,
3. Where ramps change direction.

5311.6.3 Handrails Required. Handrails shall be provided on at least one side of all ramps *that are part of a means of egress and are attached to a dwelling unit(s) where the ramp exceeds a slope of one unit vertical in 12 units horizontal (8.33% slope).*

Exception: For persons with disabilities, handrails shall be provided on both sides of the ramp when the vertical rise between landings exceeds six inches (152 mm).

5311.6.3.1 Height. Handrail height, measured above the finished surface of the ramp slope, shall be not less than 34 inches (864 mm) and not more than 38 inches (965 mm).

5311.6.3.2 Handrail Grip Size. Handrails on ramps shall comply with 780 CMR 5311.5.6.3.

5311.6.3.3 Continuity. Handrails where required on ramps shall be continuous for the full length of the ramp. Handrail ends shall be returned or shall terminate in newel posts or

safety terminals. Handrails adjacent to a wall shall have a space of not less than 1½ inches (38 mm) between the wall and the handrails.

780 CMR 5312 GUARDS

5312.1 Guards Required. Porches, balconies or raised floor surfaces located more than 30 inches (762 mm) above the floor or grade below shall have guards not less than 36 inches (914 mm) in height. Open sides of stairs with a total rise of more than 30 inches (762 mm) above the floor or grade below shall have guards not less than 34 inches (864 mm) in height measured vertically from the nosing of the treads.

Porches and decks which are enclosed with insect screening shall be provided with guards where the walking surface is located more than 30 inches (762 mm) above the floor or grade below.

5312.2 Guard Opening Limitations. Required guards on open sides of stairways, raised floor areas, balconies and porches shall have intermediate rails or ornamental closures which do not allow passage of a sphere *four inches (102 mm)* or more in diameter.

Exceptions:

1. The triangular openings formed by the riser, tread and bottom rail of a guard at the open side of a stairway are permitted to be of such a size that a sphere six inches (152 mm) cannot pass through.
2. Openings for required guards on the sides of stair treads shall not allow a sphere 4⅜ inches (107 mm) to pass through.

780 CMR 5313 LIFE SAFETY SYSTEMS

5313.1 Definitions.

COMBINATION APPLIANCE: shall mean a combination photoelectric smoke detector and carbon monoxide alarm appliance which is ac powered with battery backup. Such combination appliance shall employ both simulated voice and tone alarms features which clearly distinguishes between carbon monoxide and smoke notification, in accordance with NFPA 720, 5.3.4

MULTIPLE-STATION ALARM DEVICE. Two or more single-station devices (smoke or heat detector or carbon monoxide detector) that are capable of interconnection such that actuation of one causes all integral or separate audible alarms to operate

SINGLE-STATION ALARM DEVICE. An assembly incorporating the detector (smoke or heat detector or carbon monoxide detector), control equipment and alarm sounding device in one unit that is operated from a power supply either in the unit or obtained at the point of installation.

SMOKE DETECTOR. A listed device that senses visible or invisible particles of combustion. Only photoelectric or combination photoelectric/ionization type smoke detectors shall be permitted in Massachusetts

SYSTEM-TYPE DEVICE. A device designed to be connected to a fire alarm control unit (panel). Low-power radio transmitting (wireless) systems are included as part of this definition.

5313.2 Household Fire-warning Systems.

5313.2.1 General. The household fire-warning system shall be single or multiple station or of the system type and shall consist of smoke detectors and heat detectors as required in 780 CMR 5313.

Where more than 12 smoke alarms (detectors) are installed, system-type devices must be utilized.

5313.2.2 Listing and Installation Requirements. All fire detection, notification and protection equipment and devices shall be listed and installed in accordance with the provisions of 780 CMR 5313.2, the manufacturer's instructions, the listing criteria, 527 CMR 12.00 and NFPA 72, as applicable.

5313.2.3 Interconnection within a Dwelling Unit. When more than one code-required detector must be installed, the code-required detectors shall be compatible and interconnected in such a manner that the actuation of one detector will activate all of the audible alarms.

5313.2.4 Audible Alarm Intensity. All required alarm sounding appliances shall have a minimum rating of 85 dBA at ten feet (3048 mm). Where audible appliances are installed to provide signals for sleeping areas, they shall have a sound level of at least 75 dBA measured at the pillow level in the sleeping area.

5313.2.5 Power source. All power sources and wiring must be permanent and in accordance with 527 CMR 12.00.

5313.2.5.1 Primary Electrical Power for Single-station and Multiple-station Devices. Power for single- and multiple-station devices shall be supplied from a permanently wired connection directly to an AC primary source of power. All power for AC-powered devices shall be taken from either a dedicated locked branch circuit or a single branch circuit, which also provides other electrical service to a habitable space. The power source shall be on the supply side, ahead of any switches.

5313.2.5.2 Primary Electrical Power for System-type Household Fire-warning Systems. System-type household fire-warning systems that include a listed control unit with automatic detectors and occupant notification appliances shall be powered from a permanently wired AC primary power source. Such AC primary power shall be supplied either from a dedicated locked branch circuit or the unswitched portion of a branch circuit also used for power and lighting of a habitable space, in accordance with the requirements of NFPA 72 and 527 CMR 12.00.

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Exception: Wireless systems when installed in accordance with NFPA 72

5313.2.5.3 Secondary Electrical Power. In addition to required primary electrical power, all household fire-warning systems shall have secondary (standby) power supplied from monitored batteries in accordance with NFPA 72. For fire alarm control units (panels), the panel battery shall serve as the source of secondary electrical power. For wireless systems, the panel battery shall serve as the source of secondary electrical power.

5313.2.6 Acceptance Testing. When the installation of the household fire-warning system is complete, it shall be subject to a 100% acceptance test in accordance with 780 CMR 5313 and NFPA 72.

5313.2.7 Maintenance. It shall be the responsibility of the owner, as defined in 780 CMR 52.00, to properly maintain the household fire-warning system in accordance with manufacturer's recommendations and NFPA 72.

5313.2.8 Manufactured Homes (Housing). The installation of household fire-warning systems for buildings designed and constructed as manufactured homes and/or housing as defined by 24 CFR, Part 5208.2, shall be in accordance with approved methods for such homes and/or housing as defined 24 CFR and as such are not governed by 780 CMR 51.00 through 99.00.

5313.2.9 Smoke Detector Required Locations within the dwelling unit. Smoke detectors shall be installed in the following locations (also refer to Board of Building Regulations and Standards Official Interpretation No. 49-98):

1. In each bedroom (sleeping room).
2. Outside each separate bedroom (sleeping room) in the immediate vicinity of the bedroom (sleeping room).
3. Near the base of all stairs where such stairs lead to another occupied floor.
4. On each additional story of the dwelling, including basements and cellars but not including crawl spaces and unoccupied attics. In dwellings or dwelling units with split levels and without an intervening door between the adjacent levels, a smoke detector installed on the upper level shall suffice for the adjacent lower level, provided that the lower level is less than one full story below the upper level.
5. For each 1,200 square feet (111 m²) of area or part thereof.

5313.2.10 Smoke Detector Required Locations in Common Areas of Two-family Dwellings. In addition to the requirements of 780 CMR 5313.2.9.1 through .5., two-family dwellings that contain common areas such as basements, hallways and/or interior stairways that serve both dwelling units, but are not within the

dwelling units, shall also be provided with smoke detectors and/or heat detectors, as required, in the following locations:

1. Smoke detectors—In all common basements.
2. Smoke detectors—In all common hallways.
3. Smoke detectors—In all common stairways on each level outside the dwelling unit doorways.
4. When common area smoke detectors are of the single/multiple-station type they shall be interconnected with listed compatible heat detectors containing a sounding device within each dwelling unit. Said heat detectors shall be on every level within each dwelling unit and shall meet the audibility requirement of 780 CMR 5313.2 .4.
5. When common area smoke detectors are of the system type, there shall be at least one system-type alarm notification device that meets the requirements of 780 CMR 5313.2 .4 on each level within each dwelling unit
6. Dwelling unit smoke detectors shall only sound within the dwelling unit.

5313.2.11 Photo-electric Smoke Detectors. Any smoke detector located within 20 feet (6096 mm) of a kitchen or a bathroom shall be a photo-electric-type smoke detector. Photo-electric-type smoke detectors shall be allowed to be located closer than three feet (914 mm) horizontally from a kitchen or a bathroom door when hallway or other room size restricts detector mounting options.

Exception: A bathroom not containing a tub, shower, jacuzzi or steam room.

5313.2.12 Smoke Detector Placement. Photo-electric type smoke detectors and combination photoelectric/ionization type smoke detectors shall be installed in accordance with the manufacturer's specific installation requirements. In the absence of manufacturer's recommendations, smoke detectors shall be mounted on the ceiling at least four inches (102 mm) from a wall or on a wall with the top of the alarm not less than four inches (102 mm) nor more than 12 inches (305 mm) below the ceiling.

Exception: Smoke detector placement for solid joist or beam construction or for high, sloped, shed or peaked ceilings all shall be in accordance with manufacturer's recommendations and NFPA 72.

5313.2.13 Smoke Detector Requirements in Existing Dwellings. See 780 CMR 93.00.

5313.3 Heat Detectors.

5313.3.1 Required Heat Detectors. A single heat detector listed for the ambient environment shall be installed in:

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1. Any integral garage ("garage under") or attached garage to the main house (detached garages do not require a heat detector).

2. A new addition attached garage to an existing dwelling shall require a single heat detector installed in the garage in accordance with all applicable criteria of 780 CMR 5313. If the existing house contains a fire detection system that is compatible with the garage heat detector, then said garage heat detector shall be interconnected to the existing dwelling fire detection system. Where the dwelling-proper existing fire detection system is not compatible with the garage heat detector, the garage heat detector shall be connected to a sounder (occupant notification appliance) or compatible heat detector containing a sounding device, located in the dwelling-

proper and within 20 feet (6096 mm) of the nearest door to the garage from the dwelling-proper. The required garage heat detector is not required to incorporate audible alarm notification nor is any audible notification device required in the garage.

5313.3.2 Heat Detector Placement. For flat-finished ceilings, the single heat detector shall be placed on or near the center of the garage ceiling; for sloped ceilings having a rise to run of greater than one foot in eight feet (305 mm in 2438 mm), the single heat detector shall be placed in the approximate center of the vaulted ceiling but no closer than four inches (102 mm) to any wall.

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5313.3.3 Heat Detector Interconnection. *The required single heat detector shall be listed for and required to be interconnected to all smoke detectors of the required household fire alarm system, such that the activation of the heat detector will activate all of the audible alarms of the required household fire alarm system throughout the building. The required heat detector is not required to incorporate audible alarm notification nor is any audible notification device required in the garage.*

5313.4 Carbon Monoxide Detectors.

Note: Also refer to 527 CMR 31.00 and 248 CMR as carbon monoxide detector required locations set forth in 527 CMR 31.00 and 248 CMR must also be satisfied

5313.4.1 General. *Carbon monoxide detectors shall either be: listed, interconnected 120V or shall be part of a listed low-voltage combination system or wireless system as defined in NFPA 720.*

5313.4.1.1 Secondary power to CO alarms: *All CO alarms shall have secondary (standby) power supplied from monitored batteries in accordance with NFPA 72. For fire alarm control units (panels), the panel battery shall serve as the source of secondary electrical power. For wireless systems, the panel battery shall serve as the source of secondary electrical power.*

5313.4.2 Carbon Monoxide Detector Listing and Installation Requirements. *All carbon monoxide detectors shall be UL 2034 listed or UL 2075 listed, as applicable, and installed in accordance with the provisions of 780 CMR 51.00 through 99.00, the manufacturer's instructions, the listing criteria, 527 CMR 12.00 and NFPA 720. Required carbon monoxide detectors are not required to be interconnected to the required household fire alarm system but, where interconnection is desired, such carbon monoxide detectors shall be compatible with all interconnected fire detection devices and fire alarms shall have precedence over carbon monoxide alarms.*

5313.4.3 Carbon Monoxide Detector Required Locations. *One carbon monoxide detector shall be installed on each story of a dwelling unit, including basements and cellars (but not including crawl spaces and uninhabitable attics) in accordance with the manufacturer's instructions and the applicable requirements of NFPA 720. When mounting a carbon monoxide alarm on a story with a bedroom, the alarm, at a minimum, shall be located outside the bedroom. A carbon monoxide alarm shall be installed no more than ten ft. outside any bedroom door – these requirements do not alter the fact that all*

bedrooms must be equipped with smoke detectors/alarms but if a combination appliance is utilized, note that for CO only purposes a CO alarm is required no more than ten feet from a bedroom door and outside of the bedroom per 527 CMR 31.00.

5313.4.4 Alarm Intensity. *All alarm-sounding appliances shall have a minimum rating of 85 dBA at ten feet (3048 mm).*

5313.4.5 Maintenance. *It shall be the responsibility of the owner to properly maintain the carbon monoxide detectors in accordance with the manufacturer's instructions and NFPA 720.*

5313.5 Sprinklers.

5313.5.1 Dwellings Requiring Sprinklers. *Automatic sprinklers installed in accordance with NFPA 13D shall be installed in one- and two-family dwellings having an aggregate area greater than 14,400 square feet (1338 m²), including basements but not including garages and unfinished attics.*

780 CMR 5314 FOAM PLASTIC

5314.1 General. *The provisions of 780 CMR 5314 shall govern the requirements and uses of foam plastic insulation.*

5314.1.1 Surface Burning Characteristics. *Except where otherwise noted in 780 CMR 5314.2, all foam plastic or foam plastic cores in manufactured assemblies used in building construction shall have a flame-spread rating of not more than 75 and shall have a smoke-developed rating of not more than 450 when tested in the maximum thickness intended for use in accordance with ASTM E 84.*

5314.1.2 Thermal Barrier. *Foam plastic, except where otherwise noted, shall be separated from the interior of a building by minimum ½-inch (12.7 mm) gypsum board or an approved finish material equivalent to a thermal barrier to limit the average temperature rise of the unexposed surface to no more than 250°F (121°C) after 15 minutes of fire exposure to the ASTM E 119 standard time temperature curve. The gypsum board shall be installed using a mechanical fastening system in accordance with 780 CMR 5702.3.5. Reliance on adhesives to ensure that the gypsum board will remain in place when exposed to fire shall be prohibited.*

5314.2 Specific Requirements. *The following requirements shall apply to all uses of foam plastic unless specifically approved in accordance with 780 CMR 5314.3 or by other sections of 780 CMR 51.00 through 99.00.*

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5314.2.1 Masonry or Concrete Construction.

Foam plastics may be used without the thermal barrier described in 780 CMR 5314.1 when the foam plastic is protected by a minimum one-inch (25.4 mm) thickness of masonry or concrete.

5314.2.2 Roofing. Foam plastic may be used in a roof-covering assembly without the thermal barrier when the foam is separated from the interior of the building by wood structural panel sheathing in accordance with 780 CMR 5803, not less than $1\frac{1}{32}$ inch (11.9 mm) in thickness bonded with exterior glue and identified as Exposure 1, with edge supported by blocking or tongue-and-groove joints. The smoke-developed rating shall not be limited.

5314.2.3 Attics and Crawlspace. Within attics and crawl-spaces where entry is made only for service of utilities, foam plastics shall be protected against ignition by $1\frac{1}{2}$ -inch-thick (38 mm) mineral fiber insulation, $\frac{1}{4}$ -inch-thick (6.4 mm) wood structural panels, $\frac{3}{8}$ -inch (9.5 mm) particleboard, $\frac{1}{4}$ -inch (6.4 mm) hardboard, $\frac{3}{8}$ -inch (9.5 mm) gypsum board, or corrosion-resistant steel having a base metal thickness of 0.016 inch (0.406 mm).

5314.2.4 Foam-filled Doors. Foam-filled doors are exempt from the requirements of 780 CMR 5314.1.

5314.2.5 Siding Backer Board. Foam plastic board of not more than $\frac{1}{2}$ -inch (12.7 mm) thickness may be used as siding backer board when separated from interior spaces by not less than two inches (51 mm) of mineral fiber insulation or $\frac{1}{2}$ -inch (12.7 mm) gypsum wallboard or installed over existing exterior wall finish in conjunction with re-siding, providing the plastic board does not have a potential heat of more than 2,000 Btu per square foot (22 720 kJ/m²) when tested in accordance with NFPA 259.

5314.2.6 Interior trim. Foam plastic trim defined as picture molds, chair rails, baseboards, handrails, ceiling beams, door trim and window trim may be installed, provided:

1. The minimum density is 20 pounds per cubic foot (3.14 kg/m³).
2. The maximum thickness of the trim is 0.5 inch (12.7 mm) and the maximum width is four inches (102 mm).
3. The trim constitutes no more than 10% of the area of any wall or ceiling.
4. The flame-spread rating does not exceed 75 when tested per ASTM E 84. The smoke-developed rating is not limited.

5314.2.7 Sill Plates and Headers. Foam plastic shall be permitted to be spray applied to a sill plate and header without thermal barrier subject to all of the following:

1. The maximum thickness of the foam plastic shall be $\frac{3}{4}$ inches (82.6 mm).
2. The density of the foam plastic shall be in the range of 1.5 to 2.0 pcf (24 to 32 kg/m³).
3. The foam plastic shall have a flame spread index of 25 or less and an accompanying smoke developed index of 450 or less when tested in accordance with ASTM E84.

5314.3 Specific Approval. Plastic foam not meeting the requirements of 780 CMR 5314.1 and 5314.2 may be specifically approved on the basis of one of the following approved tests: ASTM E 84, FM 4880, UL 1040, NFPA 286, ASTM E 152, or UL 1715, or fire tests related to actual end-use configurations. The specific approval may be based on the end use, quantity, location and similar considerations where such tests would not be applicable or practical.

5314.4 Interior finish. Foam plastics that are used as interior finish shall also meet the flame-spread requirements for interior finish.

5314.5 Termite damage. The use of foam plastics in areas of "very heavy" termite infestation probability shall be in accordance with 780 CMR 5320.4.

780 CMR 5315 FLAME SPREAD AND SMOKE DENSITY

5315.1 Wall and Ceiling. Wall and ceiling finishes shall have a flame-spread classification of not greater than 200.

Exception: Flame-spread requirements for finishes shall not apply to trim defined as picture molds, chair rails, baseboards and handrails; to doors and windows or their frames; or to materials that are less than $\frac{1}{28}$ inch (0.907 mm) in thickness cemented to the surface of walls or ceilings if these materials have a flame-spread characteristic no greater than paper of this thickness cemented to a noncombustible backing.

5315.2 Smoke-developed Index. Wall and ceiling finishes shall have a smoke-developed index of not greater than 450.

5315.3 Testing. Tests shall be made in accordance with ASTM E 84.

5315.4 Alternate Test Method. As an alternate to having a flame-spread classification of not greater than 200 and a smoke developed index of not greater than 450 when tested in accordance with ASTM E 84, wall and ceiling finishes, other than textiles, shall be permitted to be tested in accordance with NFPA 286. Materials tested in accordance with NFPA 286 shall meet the following criteria:

During the 40 kW exposure, the interior finish shall comply with 780 CMR 5315.4.1. During the 160 kW exposure, the interior finish shall comply

with 780 CMR 5315.4.2. During the entire test, the interior finish shall comply with 780 CMR 5315.4.3

1. During the 40 kW exposure, flames shall not spread to the ceiling.
2. During the 160 kW exposure, the interior finish shall comply with the following:
 - 2.1. Flame shall not spread to the outer extremity of the sample on any wall or ceiling.
 - 2.2. Flashover, as defined in NFPA 286, shall not occur.
3. The total smoke released throughout the NFPA 286 test shall not exceed 1,000 m².

780 CMR 5316 INSULATION

(also see 780 CMR 61.00 as such relates to energy conservation requirements)

5316.1 Insulation. Insulation materials, including facings, such as vapor retarders or vapor permeable membranes installed within floor-ceiling assemblies, roof-ceiling assemblies, wall assemblies, crawl spaces and attics shall have a flame-spread index not to exceed 25 with an accompanying smoke-developed index not to exceed 450 when tested in accordance with ASTM E 84.

Exceptions:

1. When such materials are installed in concealed spaces, the flame-spread and smoke-developed limitations do not apply to the facings, provided that the facing is installed in substantial contact with the unexposed surface of the ceiling, floor or wall finish.
2. Cellulose loose-fill insulation, which is not spray applied, complying with the requirements of 780 CMR 5316.3, shall only be required to meet the smoke-developed index of not more than 450.

5316.2 Loose-fill Insulation. Loose-fill insulation materials that cannot be mounted in the ASTM E 84 apparatus without a screen or artificial supports shall have a flame-spread rating not to exceed 25 with an accompanying smoke-developed factor not to exceed 450 when tested in accordance with CAN/ULC-S 102.2.

Exception: Cellulose loose-fill insulation shall not be required to comply with this test method provided that such insulation complies with the requirements of 780 CMR 5316.3.

5316.3 Cellulose Loose-fill Insulation. Cellulose loose-fill insulation shall comply with CPSC 16 CFR, Parts 1209 and 1404. Each package of such insulating material shall be clearly labeled in accordance with CPSC 16 CFR, Parts 1209 and 1404.

5316.4 Exposed Attic Insulation. All exposed insulation materials installed on attic floors shall have a critical radiant flux not less than 0.12 watt per

square centimeter.

5316.5 Testing. Tests for critical radiant flux shall be made in accordance with ASTM E 970.

780 CMR 5317 DWELLING UNIT SEPARATION

5317.1 Two-family Dwellings. Dwelling units in two-family dwellings shall be separated from each other by wall and/or floor assemblies having not less than one-hour fire-resistance rating when tested in accordance with ASTM E 119. Fire-resistance-rated floor-ceiling and wall assemblies shall extend to and be tight against the exterior wall, and wall assemblies shall extend to the underside of the roof sheathing.

Exception: A fire resistance rating of ½ hour shall be permitted in buildings equipped throughout with an automatic sprinkler system installed in accordance with NFPA 13.

5317.1.1 Supporting Construction. When floor assemblies are required to be fire-resistance-rated by 780 CMR 5317.1, the supporting construction of such assemblies shall have an equal or greater fire-resistive rating.

5317.2 Townhouses. *For other than one- and two-family dwellings, refer to all applicable construction requirements of the Sixth Edition, Massachusetts State Building Code while utilizing the wind and snow loading of 780 CMR.*

5317.3 Rated Penetrations. Penetrations of wall or floor/ceiling assemblies required to be fire-resistance-rated in accordance with 780 CMR 5317.1 or 5317.2 shall be protected in accordance with 780 CMR 5317.3.

5317.3.1 Through Penetrations. Through penetrations of fire-resistance-rated wall or floor assemblies shall comply with 780 CMR 5317.3.1.1 or 5317.3.1.2.

Exception: Where the penetrating items are steel, ferrous or copper pipes or steel conduits, the annular space shall be permitted to be protected as follows:

1. In concrete or masonry wall or floor assemblies where the penetrating item is a maximum six inches (152 mm) nominal diameter and the opening is a maximum 144 square inches (92 900 mm²), concrete, grout or mortar shall be permitted where installed to the full thickness of the wall or floor assembly or the thickness required to maintain the fire-resistance rating.
2. The material used to fill the annular space shall prevent the passage of flame and hot gases sufficient to ignite cotton waste where subjected to ASTM E 119 time temperature fire conditions under a minimum positive pressure differential of 0.01 inch of

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water (3 Pa) at the location of the penetration for the time period equivalent to the fire-resistance rating of the construction penetrated.

5317.3.1.1 Fire-resistance-rated Assembly. Penetrations shall be installed as tested in the approved fire-resistance-rated assembly.

5317.3.1.2 Penetration Firestop System. Penetrations shall be protected by an approved penetration firestop system installed as tested in accordance with ASTM E 814 or UL 1479, with a minimum positive pressure differential of 0.01 inch of water (3 Pa) and shall have an F rating of not less than the required fire-resistance rating of the wall or floor/ceiling assembly penetrated.

5317.3.2 Membrane Penetrations. Membrane penetrations shall comply with 780 CMR 5317.3.1. Where walls are required to have a minimum one-hour fire resistance rating, recessed light fixtures shall be so installed such that the required fire resistance will not be reduced.

Exceptions:

1. Steel electrical boxes that do not exceed 16 square inches (0.0103m²) in area provided the total area of such openings does not exceed 100 square inches (0.0645 m² for any 100 square feet (9.29 m²) of wall area. Outlet boxes on opposite sides of the wall shall be separated as follows:

- 1.1. By a horizontal distance of not less than 24 inches (610 mm);
- 1.2. By a horizontal distance of not less than the depth of the wall cavity when the wall cavity is filled with cellulose loose-fill, rockwool or slag mineral wool insulation;
- 1.3. By solid fire blocking in accordance with 780 CMR 5602.8.1;
- 1.4. By protecting both outlet boxes by listed putty pads; or
- 1.5. By other listed materials and methods.

2. Membrane penetrations for listed electrical outlet boxes of any materials are permitted provided such boxes have been tested for use in fire resistance-rated assemblies and are installed in accordance with the instructions included in the listing. Outlet boxes on opposite sides of the wall shall be separated as follows:

- 2.1. By a horizontal distance of not less than 24 inches (610 mm);
- 2.2. By solid fire-blocking in accordance with 780 CMR 5602.8;
- 2.3. By protecting both outlet boxes by listed putty pads; or

2.4. By other listed materials and methods.

3. The annular space created by the penetration of a fire sprinkler provided it is covered by a metal escutcheon plate.

780 CMR 5318 MOISTURE VAPOR RETARDERS

5318.1 Moisture Control. In all framed walls, floors and roof/ceilings comprising elements of the building thermal envelope, a vapor retarder shall be installed on the warm-in-winter side of the insulation.

Exceptions:

1. *See the vapor retarder requirements of 780 CMR 61.00.*
2. Where the framed cavity or space is ventilated to allow moisture to escape.

780 CMR 5319 PROTECTION AGAINST DECAY

5319.1 Location Required. *The following locations shall require the use of an approved species and grade of lumber, pressure treated in accordance with AWPA C1, C2, C3, C4, C9, C15, C18, C22, C23, C24, C28, C31, C33, P1, P2 and P3, or decay-resistant heartwood of redwood, black locust, or cedars.*

1. Wood joists or the bottom of a wood structural floor when closer than 18 inches (457 mm) or wood girders when closer than 12 inches (305 mm) to the exposed ground in crawl spaces or unexcavated area located within the periphery of the building foundation.
2. All wood framing members that rest on concrete or masonry exterior foundation walls and are less than eight inches (203 mm) from the exposed ground.
3. Sills and sleepers on a concrete or masonry slab that is in direct contact with the ground unless separated from such slab by an impervious moisture barrier.
4. The ends of wood girders entering exterior masonry or concrete walls having clearances of less than 0.5 inch (12.7 mm) on tops, sides and ends.
5. Wood siding, sheathing and wall framing on the exterior of a building having a clearance of less than six inches (152 mm) from the ground.
6. Wood structural members supporting moisture-permeable floors or roofs that are exposed to the weather, such as concrete or masonry slabs, unless separated from such floors or roofs by an impervious moisture barrier.
7. Wood furring strips or other wood framing

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members attached directly to the interior of exterior masonry walls or concrete walls below grade except where an approved vapor retarder is applied between the wall and the furring strips or framing members.

5319.1.1 Ground Contact. All wood in contact with the ground and that supports permanent structures intended for human occupancy shall be approved pressure preservative treated wood suitable for ground contact use, except un-treated wood may be used where entirely below groundwater level or continuously submerged in fresh water.

5319.1.2 Geographical Areas. In geographical areas where experience has demonstrated a specific need, approved naturally durable or pressure preservatively treated wood shall be used for those portions of wood members that form the structural supports of buildings, balconies, porches or similar permanent building appurtenances when such members are exposed to the weather without adequate protection from a roof, eave, overhang or other covering that would prevent moisture or water accumulation on the surface or at joints between members. Depending on local experience, such members may include:

1. Horizontal members such as girders, joists and decking.
2. Vertical members such as posts, poles and columns.
3. Both horizontal and vertical members.

5319.1.3 Posts, Poles and Columns. Posts, poles and columns supporting permanent structures that are embedded in concrete in direct contact with the ground or embedded in concrete exposed to the weather shall be approved pressure preservatively treated wood suitable for ground contact use.

5319.1.4 Wood Columns. Wood columns shall be approved wood of natural decay resistance or approved pressure preservatively treated wood.

Exceptions:

1. Posts or columns which are either exposed to the weather or located in basements or cellars, supported by piers or metal pedestals projecting one inch (25.4 mm) above the floor or finished grade and six inches (152 mm) above exposed earth, and are separated there from by an approved impervious moisture barrier.
2. Posts or columns in enclosed crawl spaces or unexcavated areas located within the periphery of the building, supported by a concrete pier or metal pedestal at a height greater than eight inches (203 mm) from exposed ground, are separated there from by an impervious moisture barrier.

5319.2 Quality Mark. Lumber and plywood required to be pressure preservatively treated in accordance with 780 CMR 5319.1 shall bear the quality mark of an approved inspection agency that maintains continuing supervision, testing and inspection over the quality of the product and that has been approved by an accreditation body that complies with the requirements of the American Lumber Standard Committee treated wood program.

5319.2.1 Required Information. The required quality mark on each piece of pressure preservatively treated lumber or plywood shall contain the following information:

1. Identification of the treating plant.
2. Type of preservative.
3. The minimum preservative retention.
4. End use for which the product was treated.
5. Standard to which the product was treated.
6. Identity of the approved inspection agency.
7. The designation "Dry," if applicable.

Exception: Quality marks on lumber less than one inch (25.4 mm) nominal thickness, or lumber less than nominal one inch by five inches (25.4 mm by 127 mm) or two inches by four inches (51 mm by 102 mm) or lumber 36 inches (914 mm) or less in length shall be applied by stamping the faces of exterior pieces or by end labeling not less than 25% of the pieces of a bundled unit.

5319.3 Fasteners. Fasteners for pressure preservative and fire-retardant-treated wood shall be of hot-dipped galvanized steel, stainless steel, silicon bronze or copper *but such fasteners must be acceptable for the chemical preservatives utilized.*

780 CMR 5320 PROTECTION AGAINST TERMITES

5320.1 Subterranean Termite Control. In areas favorable to termite damage as established by 780 CMR Table 5301.2(1), methods of protection shall be by chemical soil treatment, pressure preservatively treated wood in accordance with the AWP standards listed in 780 CMR 5319.1, naturally termite-resistant wood or physical barriers (such as metal or plastic termite shields), or any combination of these methods. *All chemicals and chemical treatment and disposal methods shall conform to all governing laws and regulations.*

5320.1.1 Quality Mark. Lumber and plywood required to be pressure preservatively treated in accordance with 780 CMR 5320.1 shall bear the quality mark of an approved inspection agency which maintains continuing supervision, testing and inspection over the quality of the product and which has been approved by an accreditation body which complies with the requirements of the American Lumber Standard Committee treated

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wood program.

5320.2 Chemical Soil Treatment. The concentration, rate of application and treatment method of the termiticide shall be consistent with and never less than the termiticide label.

5320.3 Pressure Preservatively Treated and Naturally Resistant Wood. Heartwood of redwood and eastern red cedar shall be considered termite resistant. Pressure preservatively treated wood and naturally termite-resistant wood shall not be used as a physical barrier unless a barrier can be inspected for any termite shelter tubes around the inside and outside edges and joints of a barrier.

5320.3.1 Field Treatment. Field cut ends, notches and drilled holes of pressure preservatively treated wood shall be retreated in the field in accordance with AWP A M4.

5320.4 Foam plastic Protection. In areas where the probability of termite infestation is "very heavy" as indicated in 780 CMR Figure 5301.2(6), extruded and expanded polystyrene, polyisocyanurate and other foam plastics shall not be installed on the exterior face or under interior or exterior foundation walls or slab foundations located below grade. The clearance between foam plastics installed above grade and exposed earth shall be at least six inches (152 mm).

Exceptions:

1. Buildings where the structural members of walls, floors, ceilings and roofs are entirely of noncombustible materials or pressure preservatively treated wood.
2. When in addition to the requirements of 780 CMR 5320.1, an approved method of protecting the foam plastic and structure from subterranean termite damage is provided.
3. On the interior side of basement walls.

780 CMR 5321 SITE ADDRESS

5321.1 Premises Identification. *See M.G.L. c. 148, § 59, enforced by the head of the fire department.*

780 CMR 5322 ACCESSIBILITY

5322.1 Scope. *Refer to 780 CMR 5311.6.*

**780 CMR 5323 FLOOD-RESISTANT
CONSTRUCTION**

5323.1 General. Buildings and structures constructed in flood hazard areas (including A or V Zones) as established by *FEMA Flood Insurance Rate Maps* shall be designed and constructed in accordance with Appendix 780 CMR 120.G.

(PAGES 567 THROUGH 570 ARE RESERVED FOR FUTURE USE)

780 CMR 54.00

FOUNDATIONS

780 CMR 5401 GENERAL

5401.1 Application. The provisions of 780 CMR 54.00 shall control the design and construction of the foundation and foundation spaces for all *one- and two-family detached dwellings and accessory buildings*. Wood foundations shall be designed and installed in accordance with AF&PA Report No. 7.

Exceptions:

1. The provisions of 780 CMR 54.00 shall be permitted to be used for wood foundations only in the following situations:
 - 1.1. In buildings that have no more than two floors and a roof.
 - 1.2. When interior basement and foundation walls are provided at intervals not exceeding 50 feet.
2. In addition to the provisions of 780 CMR 54.00, the design and construction of foundations in areas prone to flooding as established by *the community's Flood Insurance Rate Map (FIRM) published by the Federal Emergency Management Agency* shall meet the provisions of 780 CMR 5323.

5401.2 Requirements. Foundation construction shall be capable of accommodating all loads according to 780 CMR 5301 and of transmitting the resulting loads to the supporting soil. Fill soils that support footings and foundations shall be designed, installed and tested in accordance with accepted engineering practice *and 780 CMR 5401.6*. Gravel fill used as footings for wood and precast concrete foundations shall comply with 780 CMR 5403.

5401.3 Drainage. Surface drainage shall be diverted to a storm sewer conveyance or other approved point of collection so as to not create a hazard. Lots shall be graded so as to drain surface water away from foundation walls. The grade away from foundation walls shall fall a minimum of six inches (152 mm) within the first ten feet (3048 mm). *Temporary and finished grading shall be such that surface water runoff, either during or after completion of construction, shall not be directed to, nor create flooding or damage to adjacent property.*

Exception: Where lot lines, walls, slopes or other physical barriers prohibit six inches (152 mm) of fall within ten feet (3048 mm), drains or swales shall be provided to ensure drainage away from the structure.

5401.4 Soil Tests. In areas likely to have expansive, compressible, shifting or other unknown soil characteristics, the building official shall determine whether to require a soil test to determine the soil's

characteristics at a particular location. This test shall be made by an approved agency using an approved method.

5401.4.1 Geotechnical Evaluation. In lieu of a complete geotechnical evaluation, the load-bearing values in 780 CMR Table 5401.4.1 shall be assumed *for the design of foundations*.

TABLE 5401.4.1 PRESUMPTIVE
LOAD-BEARING VALUES OF
FOUNDATION MATERIALS^a

CLASS OF MATERIAL	LOAD-BEARING PRESSURE (pounds per square foot)
Crystalline bedrock	12,000
Sedimentary and foliated rock	4,000
Sandy gravel and/or gravel (GW and GP)	3,000
Sand, silty sand, clayey sand, silty gravel and clayey gravel (SW, SP, SM, SC, GM and GC)	2,000
Clay, sandy clay, silty clay, clayey silt, silt and sandy silt (CL, ML, MH and CH)	1,500 ^b

For SI: 1 pound per square foot = 0.0479 kN/m².

- a. When soil tests are required by 780 CMR 5401.4, the allowable bearing capacities of the soil shall be part of the recommendations.
- b. Where the building official determines that in-place soils with an allowable bearing capacity of less than 1,500 psf are likely to be present at the site, the allowable bearing capacity shall be determined by a soils investigation.
- c. *Also refer to 780 CMR Appendix 120.R for additional guidance.*

5401.5 Compressible or Shifting Soil. When top or subsoils are compressible or shifting, such soils shall be removed to a depth and width sufficient to assure stable moisture content in each active zone and shall not be used as fill or stabilized within each active zone by chemical, dewatering, or pre-saturation.

5401.6 Engineered Fill Used to Support Foundations. *Where footings or foundations are supported on compacted fill material the compacted fill shall comply with the specifications prepared by a registered professional engineer. The specifications shall be detailed in a report which shall be submitted to and approved by the building official prior to commencement of work. The report, as a minimum, shall contain the following:*

1. *Specifications for the preparation of the site prior to the placement of the compacted fill material.*

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2. *Specifications for the material to be used as compacted fill including engineering properties.*
3. *Test method(s) to be used to determine the physical and engineering properties of the fill material after placement and compaction.*
4. *Specifications for the placement and in-place density of the fill material.*
5. *Type and frequency of field tests required in order to determine the in-place engineering properties of the fill after placement and compaction.*

Upon completion of the placement of the fill, the registered professional engineer shall prepare and submit a report to the building official as to suitability, or otherwise, of the engineered fill to support the proposed foundation system.

Exception: Compacted fill not more than 12 inches (305 mm) in depth, provided that that fill is adequately compacted using appropriate mechanical means.

780 CMR 5402 MATERIALS

5402.1 Wood Foundations. Wood foundation systems shall be designed and installed in accordance with the provisions of 780 CMR 51.00 through 99.00.

5402.1.1 Fasteners. Fasteners used below grade to attach plywood to the exterior side of exterior basement or crawl-space wall studs, or fasteners used in knee wall construction, shall be of Type 304 or 316 stainless steel. Fasteners used above grade to attach plywood and all lumber-to-lumber fasteners except those used in knee wall construction shall be of Type 304 or 316 stainless steel, silicon bronze, copper, hot-dipped galvanized (zinc coated) steel nails, or hot-tumbled

galvanized (zinc coated) steel nails. Electrogalvanized steel nails and galvanized (zinc coated) steel staples shall not be permitted.

5402.1.2 Wood Treatment. All lumber and plywood shall be treated in accordance with AWPA C22, and shall bear the label of an accredited agency showing 0.60 retention. Where lumber and/or plywood is cut or drilled after treatment, the treated surface shall be field treated with Copper Naphthenate, the concentration of which shall contain a minimum of 2% copper metal, by repeated brushing, dipping or soaking until the wood absorbs no more preservative.

5402.2 Concrete. Concrete shall have a minimum specified compressive strength as shown in 780 CMR Table 5402.2. Concrete subject to weathering as indicated in 780 CMR Table 5301.2(1) shall be air entrained as specified in 780 CMR Table 5402.2. The maximum weight of fly ash, other pozzolans, silica fume, or slag that is included in concrete mixtures for garage floor slabs and for exterior porches, carport slabs, and steps that will be exposed to deicing chemicals shall not exceed the percentages of the total weight of cementitious materials specified in ACI 318. Materials used to produce concrete and testing thereof shall comply with the applicable standards listed in ACI 318. In addition to the cements permitted by ACI 318, cement complying with ASTM C 1157 is permitted.

5402.3 Precast Concrete. Approved precast concrete foundations shall be designed and installed in accordance with the provisions of 780 CMR 51.00 through 99.00 and the manufacturer's installation instructions.

**780 CMR TABLE 5402.2
MINIMUM SPECIFIED COMPRESSIVE STRENGTH OF CONCRETE**

TYPE OR LOCATIONS OF CONCRETE CONSTRUCTION	MINIMUM SPECIFIED COMPRESSIVE STRENGTH* (f'_c)		
	Weathering potential ^b		
	Negligible	Moderate	Severe
Basement walls, foundations and other concrete not exposed to the weather	2,500	2,500	2,500 ^c
Basement slabs and interior slabs on grade, except garage floor slabs	2,500	2,500	2,500 ^c
Basement walls, foundation walls, exterior walls and other vertical concrete work exposed to the weather	2,500	3,000 ^d	3,000 ^d
Porches, carport slabs and steps exposed to the weather, and garage floor slabs	2,500	3,000 ^{d,e}	3,500 ^{d,e}

For SI: 1 pound per square inch = 6.895 kPa.

a. At 28 days psi.

b. See Table 530 1.2(1) for weathering potential.

c. Concrete in these locations that may be subject to freezing and thawing during construction shall be air-entrained concrete in accordance with Footnote d.

d. Concrete shall be air entrained. Total air content (percent by volume of concrete) shall not be less than 5% or more than 7%.

e. See 780 CMR 5402.2 for minimum cement content.

780 CMR 5403 FOOTINGS

5403.1 General. All exterior walls shall be supported on continuous solid or fully grouted masonry or concrete footings, wood foundations, or other approved structural systems which shall be of sufficient design to accommodate all loads according to 780 CMR 5301 and to transmit the resulting loads to the soil within the limitations as determined from the character of the soil. Footings shall be supported on undisturbed natural soils or engineered fill in accordance with 780 CMR 5401.6.

5403.1.1 Minimum Size. Minimum sizes for concrete and masonry footings shall be as set forth in 780 CMR Table 5403.1 and 780 CMR Figure 5403.1(1). The footing width, W, shall be based on the load-bearing value of the soil in accordance with 780 CMR Table 5401.4.1. Spread footings shall be at least six inches (152 mm) in thickness. Footing projections, P, shall be at least two inches (51 mm) and shall not exceed the thickness of the footing. The size of footings supporting piers and columns shall be based on the tributary load and allowable soil pressure in accordance with 780 CMR Table 5401.4.1. Footings for wood foundations shall be in accordance with the details set forth in 780 CMR 5403.2, and 780 CMR Figures 5403.1(2) and 5403.1(3).

**780 CMR TABLE 5403.1
MINIMUM WIDTH OF CONCRETE OR
MASONRY FOOTINGS (inches)***

	LOAD-BEARING VALUE OF SOIL (psf)			
	1500	2000	3000	4000
Conventional light-frame construction				
1-story	12	12	12	12
2-story	15	12	12	12
3-story	23	17	12	12
4-inch brick veneer over light frame or 8-inch hollow concrete masonry				
1-story	12	12	12	12
2-story	21	16	12	12
3-story	32	24	16	12
8-inch solid or fully grouted masonry				
1-story	16	12	12	12
2-story	29	21	14	12
3-story	42	32	21	16

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 0.0479 kN/m².

- a. Where minimum footing width is 12 inches, a single wythe of solid or fully grouted 12-inch nominal concrete masonry units is permitted to be used.

5403.1.2 Continuous Footings in Seismic Design Categories D₁ and D₂. *Reserved.*

5403.1.3 Seismic Reinforcing. *Reserved.*

5403.1.3.1 Foundations with Stemwalls. *Reserved.*

5403.1.3.2 Slabs-on-ground with Turned-down Footings. *Reserved.*

5403.1.4 Minimum Depth. All exterior footings shall be placed *on undisturbed ground or on engineered fill and shall be frost protected as required by 780 CMR 5403.1.4.1.*

5403.1.4.1 Frost Protection. Except where otherwise protected from frost, footings, foundation walls, piers and other permanent supports of buildings and structures shall be protected from frost by one or more of the following methods:

1. Extending a minimum of 48 inches (1219 mm) below finished grade at all points.
2. Constructing in accordance with 780 CMR 5403.3;
3. Constructing in accordance with ASCE 32-01;
4. Erected on solid rock.

Exceptions:

1. Freestanding accessory structures, except garages, with an area of 400 square feet (37 m²) or less and an eave height of ten feet (3048 mm) or less shall not be required to be protected.
2. When the foundation grade is established by a registered architect or registered professional engineer.

Footings shall not bear, or be placed on frozen soil.

5403.1.4.2 Seismic Conditions. *Reserved.*

5403.1.5 Slope. The top surface of footings shall be level. The bottom surface of footings shall not have a slope exceeding one unit vertical in ten units horizontal (10% slope). Footings shall be stepped where it is necessary to change the elevation of the top surface of the footings or where the slope of the bottom surface of the footings will exceed one unit vertical in ten units horizontal (10% slope).

5403.1.6 Foundation Anchorage. When braced wall panels are supported directly on continuous foundations, the wall wood sill plate or cold-formed steel bottom track shall be anchored to the foundation in accordance with 780 CMR 5403.

The wood sole plate at exterior walls on monolithic slabs and wood sill plate supporting floor systems shall be anchored to the foundation with 1/2-inch (minimum)-diameter (12.7mm) A 307 steel anchor bolts with nuts and plate washers spaced a maximum of six feet (1829 mm) on center. There shall be a minimum of two bolts per plate section with bolts located not more than 12 inches (305 mm) or less than seven bolt diameters from each end of the plate section.

Anchor bolts shall extend a minimum of seven inches (178 mm) into masonry or concrete. Sills and sole plates shall be protected against decay and termites where required by 780 CMR 5318

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and 5319. Cold-formed steel framing systems shall be fastened to the wood sill plates or anchored directly to the foundation as required in 780 CMR 5505.3.1 or 5603.1.1.

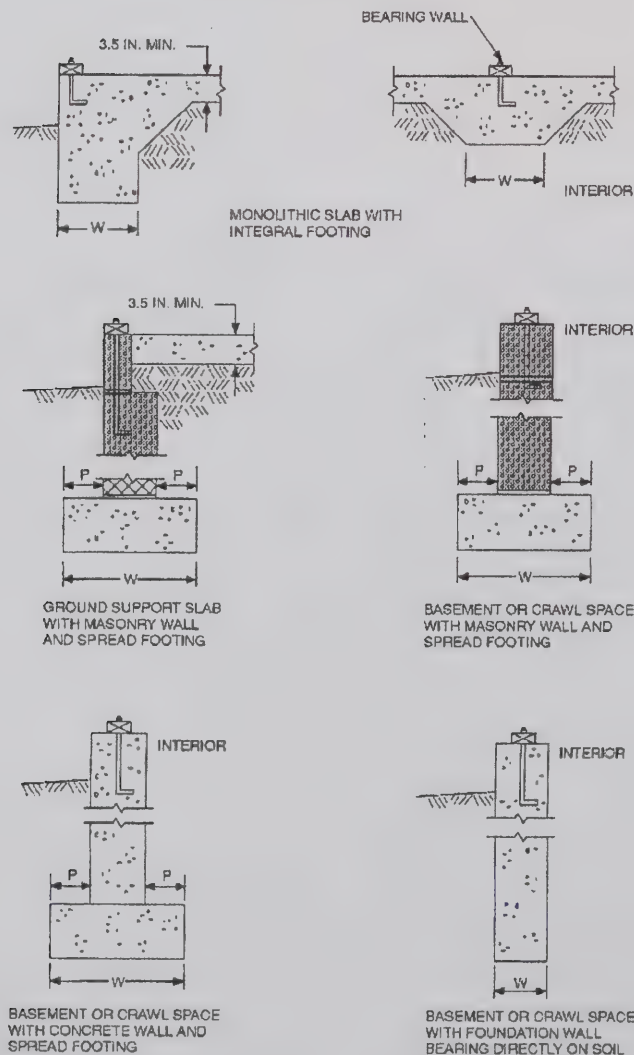
Exception: Foundation anchor straps, spaced as required to provide equivalent anchorage to ½-inch-diameter (12.7mm) anchor bolts and installed in accordance with manufacturer's printed instructions.

5403.1.6.1 Foundation Anchorage in Seismic Design Categories C, D₁ and D₂. Reserved.

5403.1.7 Footings on or Adjacent to Slopes. The placement of buildings and structures on or adjacent to slopes steeper than 1 unit vertical in three units horizontal (33.3% slope) shall conform to 780 CMR 5403.1.7.1 through 5403.1.7.4.

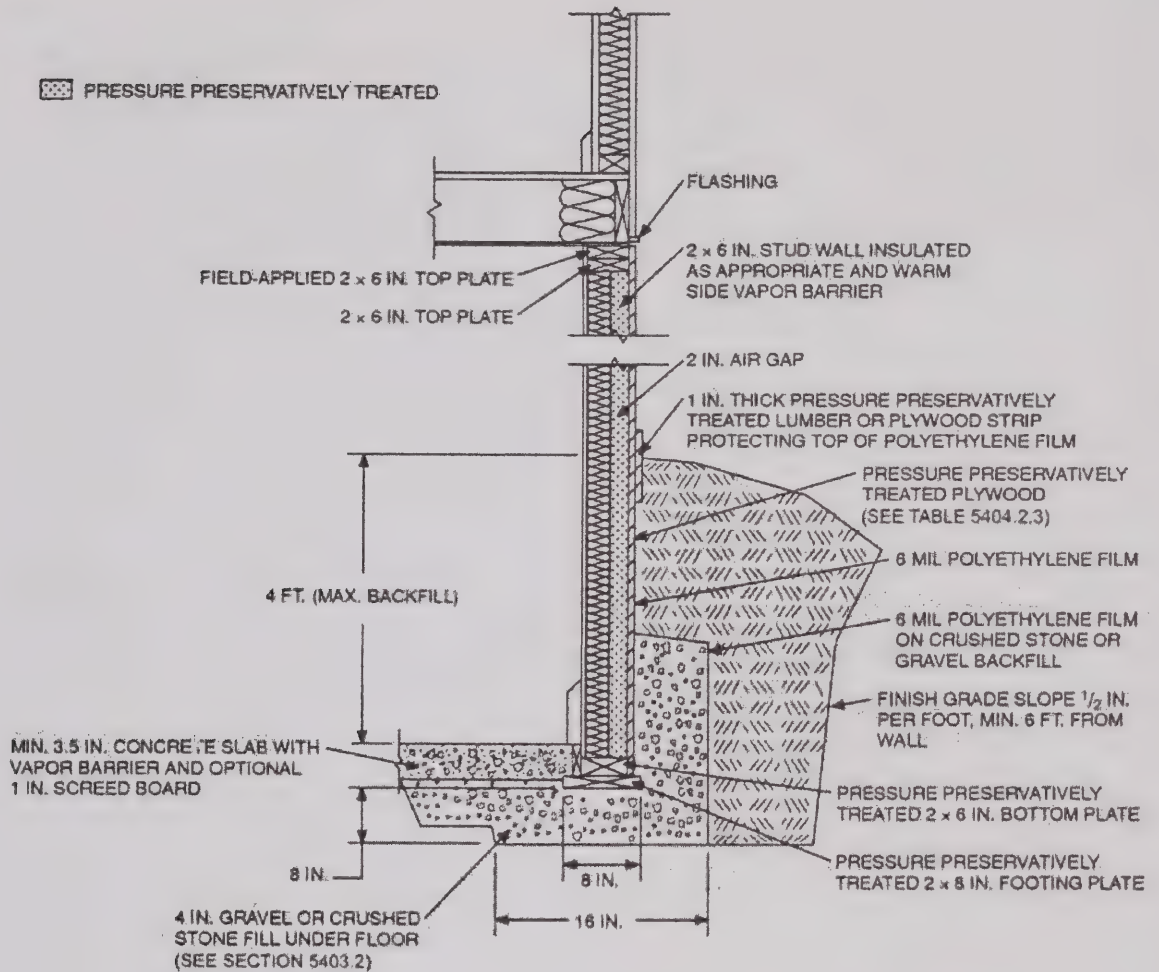
5403.1.7.1 Building Clearances from Ascending Slopes. In general, buildings below slopes shall be set a sufficient distance from the slope to provide protection from slope drainage, erosion and shallow failures. Except as provided in 780 CMR 5403.1.7.4 and 780 CMR Figure 5403.1.7.1, the following criteria will be assumed to provide this protection. Where the existing slope is steeper than one unit vertical in one unit horizontal (100% slope), the toe of the slope shall be assumed to be at the intersection of a horizontal plane drawn from the top of the foundation and a plane drawn tangent to the slope at an angle of 45 degrees (0.79 rad) to the horizontal. Where a retaining wall is constructed at the toe of the slope, the height of the slope shall be measured from the top of the wall to the top of the slope.

780 CMR FIGURE 5403.1(1)
CONCRETE AND MASONRY FOUNDATION DETAILS



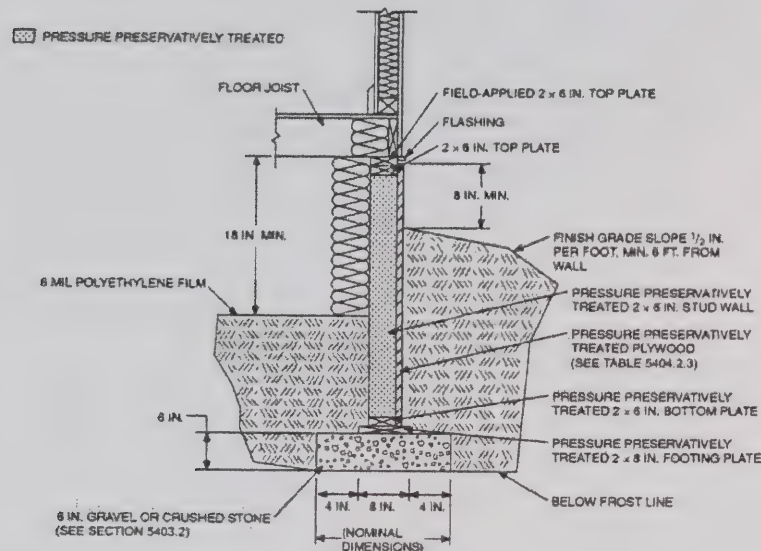
For SI: 1 inch = 25.4 mm.

780 CMR FIGURE 5403.1(2)
PERMANENT WOOD FOUNDATION BASEMENT WALL SECTION



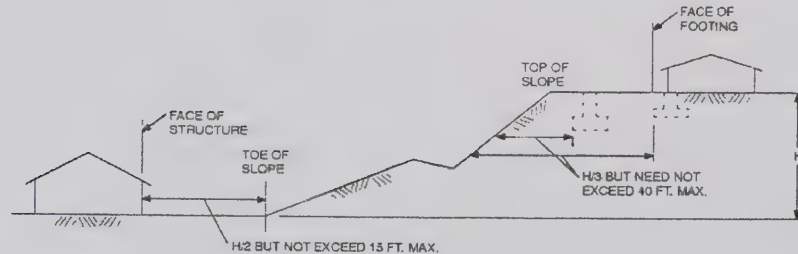
For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm.

780 CMR FIGURE 5403.1(3)
PERMANENT WOOD FOUNDATION CRAWL SPACE SECTION



For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm.

780 CMR FIGURE 5403.1.7.1
FOUNDATION CLEARANCE FROM SLOPES



For SI: 1 foot = 304.8 mm.

5403.1.7.2 Footing Setback from Descending Slope Surfaces. Footings on or adjacent to slope surfaces shall be founded in material with an embedment and setback from the slope surface sufficient to provide vertical and lateral support for the footing without detrimental settlement. Except as provided for in 780 CMR 5403.1.7.4 and Figure 5403.1.7.1, the following setback is deemed adequate to meet the criteria. Where the slope is steeper than one unit vertical in one unit horizontal (100% slope), the required setback shall be measured from an imaginary plane 45 degrees (0.79 rad) to the horizontal, projected upward from the toe of the slope.

5403.1.7.3 Foundation Elevation. On graded sites, the top of any exterior foundation shall extend above the elevation of the street gutter

at point of discharge or the inlet of an approved drainage device a minimum of 12 inches (305 mm) plus 2%. Alternate elevations are permitted subject to the approval of the building official, provided it can be demonstrated that required drainage to the point of discharge and away from the structure is provided at all locations on the site.

5403.1.7.4 Alternate Setback and Clearances. Alternate setbacks and clearances are permitted, subject to the approval of the building official. The building official is permitted to require an investigation and recommendation of a qualified engineer to demonstrate that the intent of 780 CMR 5403 has been satisfied. Such an investigation shall include consideration of material, height of slope, slope gradient, load intensity and erosion

characteristics of slope material.

5403.1.8 Foundations on Expansive Soils. Foundation and floor slabs for buildings located on expansive soils shall be designed in accordance with *780 CMR Chapter 18, as applicable, of the Sixth Edition, Massachusetts State Building Code*.

Exception: Slab-on-ground and other foundation systems which have performed adequately in soil conditions similar to those encountered at the building site are permitted subject to the approval of the building official.

5403.1.8.1 Expansive Soils Classifications. Soils meeting all four of the following provisions shall be considered expansive, except that tests to show compliance with 780 CMR 5403.1.8.1.1., 2. and 3. shall not be required if the test prescribed in 780 CMR 5403.1.8.1.4 is conducted:

1. Plasticity Index (PI) of 15 or greater, determined in accordance with ASTM D 4318.

2. More than 10% of the soil particles pass a No. 200 sieve (75 mm), determined in accordance with ASTM D 422.
3. More than 10% of the soil particles are less than 5 micrometers in size, determined in accordance with ASTM D 422.
4. Expansion Index greater than 20, determined in accordance with ASTM D4829.

5403.2 Footings for Wood Foundations. Footings for wood foundations shall be in accordance with 780 CMR Figure 5403.1(2) and 780 CMR Figure 5403.1(3). Gravel shall be washed and well graded. The maximum size stone shall not exceed $\frac{3}{4}$ inch (19.1 mm). Gravel shall be free from organic, clayey or silty soils. Sand shall be coarse, not smaller than $\frac{1}{16}$ -inch (1.6 mm) grains and shall be free from organic, clayey or silty soils. Crushed stone shall have a maximum size of $\frac{1}{2}$ inch (12.7 mm).

5403.3 Frost Protected Shallow Foundations. *Reserved.*

780 CMR TABLE 5403.3
MINIMUM INSULATION REQUIREMENTS FOR FROST-PROTECTED
FOOTINGS IN HEATED BUILDINGS^a
RESERVED

780 CMR FIGURE 5403.3(1)
INSULATION PLACEMENT FOR FROST-PROTECTED FOOTINGS IN HEATED BUILDINGS
RESERVED

780 CMR FIGURE 5403.3(3)
INSULATION PLACEMENT FOR FROST-PROTECTED FOOTINGS
ADJACENT TO UNHEATED SLAB-ON-GROUND STRUCTURE
RESERVED

780 CMR FIGURE 5403.3(4)
INSULATION PLACEMENT FOR FROST-PROTECTED FOOTINGS ADJACENT TO
HEATED STRUCTURE
RESERVED

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780 CMR 5404 FOUNDATION WALLS**5404.1 Concrete and Masonry Foundation Walls.**

Concrete and masonry foundation walls shall be selected and constructed in accordance with the provisions of 780 CMR 5404 or in accordance with ACI 318, NCMA TR68-A or ACI 530/ASCE 5/TMS 402 or other approved structural standards. *Foundation walls which are not constructed in accordance with the prescriptive provisions of 780 CMR 51.00 through 99.00 shall be designed by a registered professional engineer or registered architect and shall comply with applicable standards as referenced in 780 CMR 100.00 Appendix A.*

5404.1.1 Masonry Foundation Walls. Concrete masonry and clay masonry foundation walls shall be constructed as set forth in 780 CMR Tables 5404.1.1(1), 5404.1.1(2), 5404.1.1(3) and 5404.1.1(4) and shall also comply with the provisions of 780 CMR 5404 and the applicable provisions of 780 CMR 5606, 5607 and 5608. Rubble stone masonry foundation walls shall be

constructed in accordance with 780 CMR 5404.1.8 and 5606.2.2.

5404.1.2 Concrete Foundation Walls. Concrete foundation walls shall be constructed as set forth in 780 CMR Tables 5404.1.1(1), 5404.1.1(2), 5404.1.1(3) and 5404.1.1(4), and shall also comply with the provisions of 780 CMR 5404 and the applicable provisions of 780 CMR 5402.2.

5404.1.3 Design required. A design in accordance with accepted engineering practice and prepared by a registered professional engineer or registered architect shall be provided for concrete or masonry foundation walls when any of the following conditions exist:

1. Walls are subject to hydrostatic pressure from groundwater.
2. Walls supporting more than 48 inches (1219 mm) of unbalanced backfill that do not have permanent lateral support at the top and bottom.

780 CMR TABLE 5404.1.1(1)**PLAIN CONCRETE AND PLAIN MASONRY FOUNDATION WALLS**

MAXIMUM WALL HEIGHT (feet)	MAXIMUM UNBALANCED BACKFILL HEIGHT ^c (feet)	PLAIN CONCRETE MINIMUM NOMINAL WALL THICKNESS (inches)			PLAIN MASONRY ^a MINIMUM NOMINAL WALL THICKNESS (inches)		
		Soil classes ^b					
		GW, GP, SW and SP	GM, GC, SM, SM-SC and ML	SC, MH, ML-CL and inorganic CL	GW, GP, SW and SP	GM, GC, SM, SM-SC and ML	SC, MH, ML-CL and inorganic CL
5	4	6	6	6	6 solid ^d or 8	6 solid ^d or 8	6 solid ^d or 8
	5	6	6	6	6 solid ^d or 8	8	10
6	4	6	6	6	6 solid ^d or 8	6 solid ^d or 8	6 solid ^d or 8
	5	6	6	6	6 solid ^d or 8	8	10
	6	6	8 ^g	8 ^g	8	10	12
7	4	6	6	6	6 solid ^d or 8	8	8
	5	6	6	8 ^g	6 solid ^d or 8	10	10
	6	6	8	8	10	12	10 solid ^d
	7	8	8	10	12	10 solid ^d	12 solid ^d
8	4	6	6	6	6 solid ^d or 8	6 solid ^d or 8	8
	5	6	6	8	6 solid ^d or 8	10	12
	6	8 ^g	8	10	10	12	12 solid ^d
	7	8	10	10	12	12 solid ^d	Footnote e
	8	10	10	12	10 solid ^d	12 solid ^d	Footnote e
9	4	6	6	6	6 solid ^d or 8	6 solid ^d or 8	8
	5	6	8 ^g	8	8	10	12
	6	8	8	10	10	12	12 solid ^d
	7	8	10	10	12	12 solid ^d	Footnote e
	8	10	10	12	12 solid ^d	Footnote e	Footnote e
	9	10	12	Footnote f	Footnote e	Footnote e	Footnote e

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square inch = 6.895 Pa.

- a. Mortar shall be Type M or S and masonry shall be laid in running bond. UngROUTED hollow masonry units are permitted except where otherwise indicated.
- b. Soil classes are in accordance with the Unified Soil Classification System. Refer to 780 CMR Table 5405.1.
- c. Unbalanced backfill height is the difference in height of the exterior and interior finish ground levels. Where an interior concrete slab is provided, the unbalanced backfill height shall be measured from the exterior finish ground level to the top of the interior concrete slab.
- d. Solid grouted hollow units or solid masonry units.
- e. Wall construction shall be in accordance with 780 CMR Table 5404.1.1(2) or a design shall be provided.
- f. A design is required.
- g. Thickness may be 6 inches, provided minimum specified compressive strength of concrete, f'_c , is 4,000 psi.

FOUNDATIONS FOR SINGLE- AND TWO-FAMILY DWELLINGS

780 CMR TABLE 5404.1.1(2)
REINFORCED CONCRETE AND MASONRY^a FOUNDATION WALLS

MAXIMUM WALL HEIGHT (feet)	MAXIMUM UNBALANCED BACKFILL HEIGHT* (feet)	MINIMUM VERTICAL REINFORCEMENT SIZE AND SPACING ^{b,c} FOR 8-INCH NOMINAL WALL THICKNESS		
		Soil classes ^d		
		GW, GP, SW and SP soils	GM, GC, SM, SM-SC and ML soils	SC, MH, ML-CL and inorganic CL soils
6	5	#4 at 48" o.c.	#4 at 48" o.c.	#4 at 48" o.c.
	6	#4 at 48" o.c.	#4 at 40" o.c.	#5 at 48" o.c.
7	4	#4 at 48" o.c.	#4 at 48" o.c.	#4 at 48" o.c.
	5	#4 at 48" o.c.	#4 at 48" o.c.	#4 at 40" o.c.
	6	#4 at 48" o.c.	#5 at 48" o.c.	#5 at 40" o.c.
8	7	#4 at 40" o.c.	#5 at 40" o.c.	#6 at 48" o.c.
	5	#4 at 48" o.c.	#4 at 48" o.c.	#4 at 40" o.c.
	6	#4 at 48" o.c.	#5 at 48" o.c.	#5 at 40" o.c.
	7	#5 at 48" o.c.	#6 at 48" o.c.	#6 at 40" o.c.
9	8	#5 at 40" o.c.	#6 at 40" o.c.	#6 at 24" o.c.
	5	#4 at 48" o.c.	#4 at 48" o.c.	#5 at 48" o.c.
	6	#4 at 48" o.c.	#5 at 48" o.c.	#6 at 48" o.c.
	7	#5 at 48" o.c.	#6 at 48" o.c.	#6 at 32" o.c.
	8	#5 at 40" o.c.	#6 at 32" o.c.	#6 at 24" o.c.
	9	#6 at 40" o.c.	#6 at 24" o.c.	#6 at 16" o.c.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

- Mortar shall be Type M or S and masonry shall be laid in running bond.
- Alternative reinforcing bar sizes and spacings having an equivalent cross-sectional area of reinforcement per lineal foot of wall shall be permitted provided the spacing of the reinforcement does not exceed 72 inches.
- Vertical reinforcement shall be Grade 60 minimum. The distance from the face of the soil side of the wall to the center of vertical reinforcement shall be at least five inches.
- Soil classes are in accordance with the Unified Soil Classification System. Refer to 780 CMR Table 5405.1.
- Unbalanced backfill height is the difference in height of the exterior and interior finish ground levels. Where an interior concrete slab is provided, the unbalanced backfill height shall be measured from the exterior finish ground level to the top of the interior concrete slab.

780 CMR TABLE 5404.1.1(3)
REINFORCED CONCRETE AND MASONRY^a FOUNDATION WALLS

MAXIMUM WALL HEIGHT (feet)	MAXIMUM UNBALANCED BACKFILL HEIGHT* (feet)	VERTICAL REINFORCEMENT SIZE AND SPACING ^{b,c} FOR 12-INCH NOMINAL WALL THICKNESS		
		Soil classes ^d		
		GW, GP, SW and SP soils	GM, GC, SM, SM-SC and ML soils	SC, MH, ML-CL and inorganic CL soils
7	4	#4 at 72" o.c.	#4 at 72" o.c.	#4 at 72" o.c.
	5	#4 at 72" o.c.	#4 at 72" o.c.	#4 at 72" o.c.
	6	#4 at 72" o.c.	#4 at 64" o.c.	#4 at 48" o.c.
	7	#4 at 72" o.c.	#4 at 48" o.c.	#5 at 56" o.c.
8	5	#4 at 72" o.c.	#4 at 72" o.c.	#4 at 72" o.c.
	6	#4 at 72" o.c.	#4 at 56" o.c.	#5 at 72" o.c.
	7	#4 at 64" o.c.	#5 at 64" o.c.	#4 at 32" o.c.
	8	#4 at 48" o.c.	#4 at 32" o.c.	#5 at 40" o.c.
9	5	#4 at 72" o.c.	#4 at 72" o.c.	#4 at 72" o.c.
	6	#4 at 72" o.c.	#4 at 56" o.c.	#5 at 64" o.c.
	7	#4 at 56" o.c.	#4 at 40" o.c.	#6 at 64" o.c.
	8	#4 at 64" o.c.	#6 at 64" o.c.	#6 at 48" o.c.
	9	#5 at 56" o.c.	#7 at 72" o.c.	#6 at 40" o.c.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

- Mortar shall be Type M or S and masonry shall be laid in running bond.
- Alternative reinforcing bar sizes and spacing having an equivalent cross-sectional area of reinforcement per lineal foot of wall shall be permitted provided the spacing of the reinforcement does not exceed 72 inches.
- Vertical reinforcement shall be Grade 60 minimum. The distance from the face of the soil side of the wall to the center of vertical reinforcement shall be at least 8.75 inches.
- Soil classes are in accordance with the Unified Soil Classification System. Refer to 780 CMR Table 5405.1.
- Unbalanced backfill height is the difference in height of the exterior and interior finish ground levels. Where an interior concrete slab is provided, the unbalanced backfill height shall be measured from the exterior finish ground level to the top of the interior concrete slab.

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780 CMR TABLE 5404.1 .1 (4)
REINFORCED CONCRETE AND MASONRY* FOUNDATION WALLS

MAXIMUM WALL HEIGHT (feet)	MAXIMUM UNBALANCED BACKFILL HEIGHT ^b (feet)	MINIMUM VERTICAL REINFORCEMENT SIZE AND SPACING ^{b,c} FOR 10-INCH NOMINAL WALL THICKNESS		
		Soil Classes ^d		
		GW, GP, SW and SP soils	GM, GC, SM, SM-SC and ML soils	SC, MH, ML-CL and inorganic CL soils
7	4	#4 at 56" o.c.	#4 at 56" o.c.	#4 at 56" o.c.
	5	#4 at 56" o.c.	#4 at 56" o.c.	#4 at 56" o.c.
	6	#4 at 56" o.c.	#4 at 48" o.c.	#4 at 40" o.c.
	7	#4 at 56" o.c.	#5 at 56" o.c.	#5 at 40" o.c.
8	5	#4 at 56" o.c.	#4 at 56" o.c.	#4 at 48" o.c.
	6	#4 at 56" o.c.	#4 at 48" o.c.	#5 at 56" o.c.
	7	#4 at 48" o.c.	#4 at 32" o.c.	#6 at 56" o.c.
	8	#5 at 56" o.c.	#5 at 40" o.c.	#7 at 56" o.c.
9	5	#4 at 56" o.c.	#4 at 56" o.c.	#4 at 48" o.c.
	6	#4 at 56" o.c.	#4 at 40" o.c.	#4 at 32" o.c.
	7	#4 at 56" o.c.	#5 at 48" o.c.	#6 at 48" o.c.
	8	#4 at 32" o.c.	#6 at 48" o.c.	#4 at 16" o.c.
	9	#5 at 40" o.c.	#6 at 40" o.c.	#7 at 40" o.c.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

- Mortar shall be Type M or S and masonry shall be laid in running bond.
- Alternative reinforcing bar sizes and spacings having an equivalent cross-sectional area of reinforcement per lineal foot of wall shall be permitted provided the spacing of the reinforcement does not exceed 72 inches.
- Vertical reinforcement shall be Grade 60 minimum. The distance from the face of the soil side of the wall to the center of vertical reinforcement shall be at least 6.75 inches.
- Soil classes are in accordance with the Unified Soil Classification System. Refer to Table 5405.1.
- Unbalanced backfill height is the difference in height of the exterior and interior finish ground levels. Where an interior concrete slab is provided, the unbalanced backfill height shall be measured from the exterior finish ground level to the top of the interior concrete slab.

5404.1.4 Seismic Design Categories D₁ and D₂.
Reserved.

5404.1.5 Foundation Wall Thickness Based on Walls Supported. The thickness of concrete and masonry foundation walls shall not be less than the thickness of the wall supported, except that foundation walls of at least eight-inch (203 mm) nominal thickness shall be permitted under brick-veneered frame walls and under ten-inch-wide (254mm) cavity walls where the total height of the wall supported, including gables, is not more than 20 feet (6096 mm), provided the requirements of 780 CMR 5404.1.1 and 5404.1.2 are met.

5404.1.5.1 Pier and Curtain Wall Foundations. Pier and curtain wall foundations shall be permitted to be used to support light-frame construction not more than two stories in height, provided the following requirements are met:

- All load-bearing walls shall be placed on continuous concrete footings placed integrally with the exterior wall footings.
- The minimum actual thickness of a

load-bearing masonry wall shall be not less than four inches (102 mm) nominal or $3\frac{3}{8}$ inches (92 mm) actual thickness, and shall be bonded integrally with piers spaced in accordance with 780 CMR 5606.8.

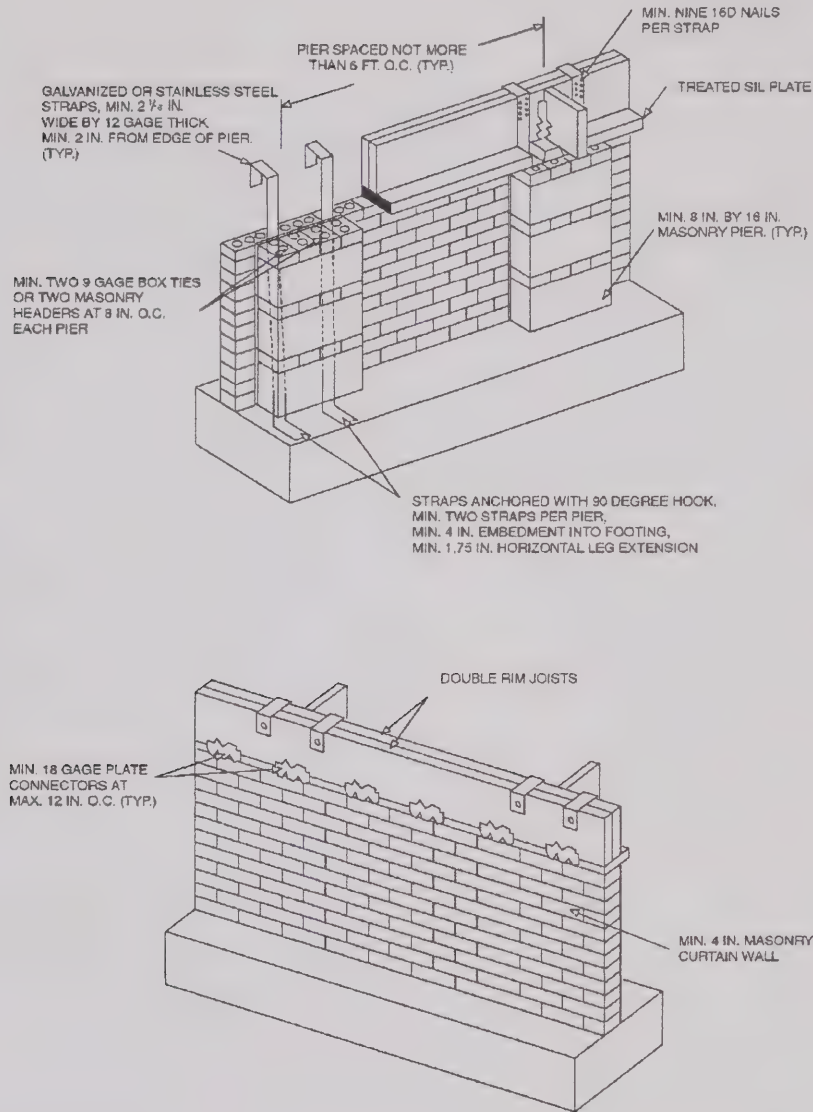
3. Piers shall be constructed in accordance with 780 CMR 5606.5 and 780 CMR 5606.5.1, and shall be bonded into the load-bearing masonry wall in accordance with 780 CMR 5608.1.1 or 780 CMR 5608.1.1.2.

4. The maximum height of a four-inch (102 mm) load-bearing masonry foundation wall supporting wood framed walls and floors shall not be more than four feet (1219 mm) in height.

5. Anchorage shall be in accordance with 780 CMR 5403.1.6, 780 CMR Figure 5404.1.5(1), or as specified by engineered design accepted by the building official.

6. The unbalanced fill for four-inch (102 mm) foundation walls shall not exceed 24 inches (610 mm) for solid masonry or 12 inches (305 mm) for hollow masonry.

780 CMR FIGURE 5404.1.5(1)
FOUNDATION WALL CLAY MASONRY CURTAIN WALL
WITH CONCRETE MASONRY PIERS



For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 degree = 0.79/ 45 rad.

5404.1.6 Height above Finished Grade.

Concrete and masonry foundation walls shall extend above the finished grade adjacent to the foundation at all points a minimum of four inches (102 mm) where masonry veneer is used and a minimum of six inches (152 mm) elsewhere.

5404.1.7 Backfill Placement. Backfill shall not be placed against the wall until the wall has sufficient strength and has been anchored to the floor above, or has been sufficiently braced to prevent damage by the backfill. *Backfill material shall be free draining and free of organic materials, construction debris, cobbles and boulders, shall be placed in lifts not exceeding*

12 inches (305 mm) and shall be mechanically compacted.

Exception: Such bracing is not required for walls supporting less than four feet (1219 mm) of unbalanced backfill.

5404.1.8 Rubble Stone Masonry. Rubble stone masonry foundation walls shall have a minimum thickness of 16 inches (406 mm), shall not support an unbalanced backfill exceeding eight feet (2438 mm) in height, shall not support a soil pressure greater than 30 psf (481 kg/m²).

5404.2 Wood Foundation Walls. Wood foundation walls shall be constructed in accordance with the

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provisions of 780CMR 5404.2.1 through 5404.2.6 and with the details shown in 780 CMR Figures 5403.1(2) and 5403.1(3).

5404.2.1 Identification. All load-bearing lumber shall be identified by the grade mark of a lumber grading or inspection agency which has been approved by an accreditation body that complies with DOC PS 20. In lieu of a grade mark, a certificate of inspection issued by a lumber grading or inspection agency meeting the requirements of 780 CMR 5404 shall be accepted. Wood structural panels shall conform to DOC PS 1 or DOC PS 2 and shall be identified by a grade mark or certificate of inspection issued by an approved agency.

5404.2.2 Stud Size. The studs used in foundation walls shall be two-inch-by-six-inch (51 mm by

152 mm) members. When spaced 16 inches (406 mm) on center, a wood species with an Fb value of not less than 1,250 (8612 kPa) as listed in AF&PA/NDS shall be used. When spaced 12 inches (305 mm) on center, an Fb of not less than 875 (6029 kPa) shall be required.

5404.2.3 Height of Backfill. For wood foundations that are not designed and installed in accordance with AF&PA Report No.7, the height of backfill against a foundation wall shall not exceed four feet (1219 mm). When the height of fill is more than 12 inches (305 mm) above the interior grade of a crawl space or floor of a basement, the thickness of the plywood sheathing shall meet the requirements of 780 CMR Table 5404.2.3.

TABLE 5404.2.3
PLYWOOD GRADE AND THICKNESS FOR WOOD FOUNDATION CONSTRUCTION
(30 pcf equivalent-fluid weight soil pressure)

HEIGHT OF FILL (inches)	STUD SPACING (inches)	FACE GRAIN ACROSS STUDS			FACE GRAIN PARALLEL TO STUDS		
		Grade ^a	Minimum thickness (inches)	Span Rating	Grade ^a	Minimum thickness (inches) ^{b,c}	Span Rating
24	12	B	$1\frac{5}{32}$	32/16	A	$1\frac{5}{32}$	32/16
					B	$1\frac{5}{32}^c$	32/16
	16	B	$1\frac{5}{32}$	32/16	A	$1\frac{5}{32}^c$	32/16
					B	$1\frac{9}{32}^c$ (4, 5 ply)	40/20
36	12	B	$1\frac{5}{32}$	32/16	A	$1\frac{5}{32}$	32/16
					B	$1\frac{5}{32}^c$ (4, 5 ply)	32/16
					B	$1\frac{9}{32}^c$ (4, 5 ply)	40/20
	16	B	$1\frac{5}{32}^c$	32/16	A	$1\frac{9}{32}$	40/20
					B	$2\frac{3}{32}$	48/24
48	12	B	$1\frac{5}{32}$	32/16	A	$1\frac{5}{32}^c$	32/16
					B	$1\frac{9}{32}^c$ (4, 5 ply)	40/20
	16	B	$1\frac{9}{32}$	40/20	A	$1\frac{9}{32}^c$	40/20
					A	$2\frac{3}{32}$	48/24

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per cubic foot = 0.1572 kN/m³.

a. Plywood shall be of the following minimum grades in accordance with DOC PS 1 or DOC PS 2:

1. DOC PS 1 Plywood grades marked:

- 1.1. Structural I C-D (Exposure 1)
- 1.2. C-D (Exposure 1)

2. DOC PS 2 Plywood grades marked:

- 2.1. Structural I Sheathing (Exposure 1)
- 2.2. Sheathing (Exposure 1)

3. Where a major portion of the wall is exposed above ground and a better appearance is desired, the following plywood grades marked exterior are suitable:

- 3.1. Structural I A-C, Structural I B-C or Structural I C-C (Plugged) in accordance with DOC PS 1
- 3.2. A-C Group 1, B-C Group 1, C-C (Plugged) Group 1 or MDO Group 1 in accordance with DOC PS 1
- 3.3. Single Floor in accordance with DOC PS 1 or DOC PS 2

b. Minimum thickness $1\frac{5}{32}$ inch, except crawl space sheathing may be $\frac{3}{8}$ inch for face grain across studs 16 inches on center and maximum two-foot depth of unequal fill.

c. For this fill height, thickness and grade combination, panels that are continuous over less than three spans (across less than three stud spacings) require blocking 16 inches above the bottom plate. Offset adjacent blocks and fasten through studs with two 16d corrosion-resistant nails at each end.

5404.2.4 Backfilling. Wood foundation walls shall not be backfilled until the basement floor and first floor have been constructed or the walls have been braced. For crawl space construction, backfill or bracing shall be installed on the interior of the walls prior to placing backfill on the exterior. *Backfill material shall be free draining and free of organic materials, construction debris, cobbles and boulders, shall be placed in lifts not exceeding 12 inches (305 mm) and shall be mechanically compacted.*

5404.2.5 Drainage and Dampproofing. Wood foundation basements shall be drained and dampproofed in accordance with 780CMR 5405 and 5406, respectively.

5404.2.6 Fastening. Wood structural panel foundation wall sheathing shall be attached to framing in accordance with 780 CMR Table 5602.3(1) and 780 CMR 5402.1.1.

5404.3 Wood Sill Plates. Wood sill plates shall be a minimum of two-inch by four-inch (51 mm by 102 mm) nominal lumber. Sill plate anchorage shall be in accordance with 780 CMR 5403.1.6 and 5602.11.

5404.4 Insulating Concrete Form Foundation Walls. Insulating concrete form (ICF) foundation walls shall be designed and constructed in accordance with the provisions of 780 CMR 5404 or in accordance with the provisions of ACI 318. When ACI 318 is used to design insulating concrete form foundation walls, project drawings, typical details and specifications *shall* bear the seal of the *a Massachusetts-registered architect or a Massachusetts-registered professional engineer.*

5404.4.1 Applicability Limits. The provisions of 780 CMR 5404.4.1 shall apply to the construction of insulating concrete form foundation walls for

buildings not greater than 60 feet (18 288 mm) in plan dimensions, and floors not greater than 32 feet (9754 mm) or roofs not greater than 40 feet (12 192 mm) in clear span. Buildings shall not exceed two stories in height above-grade with each story not greater than ten feet (3048 mm) high. Foundation walls constructed in accordance with the provisions of 780 CMR 5404.4.1 shall be limited to buildings subjected to a maximum ground snow load of 70 psf (3.35 kN/m²) and located in Seismic Design Category A, B or C.

5404.4.2 Flat Insulating Concrete Form Wall Systems. Flat ICF wall systems shall comply with 780 CMR Figure 5611.3, shall have a minimum concrete thickness of 5.5 inches (140 mm), and shall have reinforcement in accordance with 780 CMR Table 5404.4(1), 5404.4(2) or 5404.4(3).

5404.4.3 Waffle Grid Insulating Concrete Form Wall Systems. Waffle-grid wall systems shall have a minimum nominal concrete thickness of six inches (152 mm) for the horizontal and vertical concrete members (cores) and shall be reinforced in accordance with 780 CMR Table 5404.4(4). The minimum core dimension shall comply with 780 CMR Table 5611.4 (2) and 780 CMR Figure 5611.4.

5404.4.4 Screen Grid Insulating Concrete Form Wall Systems. Screen-grid ICF wall systems shall have a minimum nominal concrete thickness of six inches (152 mm) for the horizontal and vertical concrete members (cores). The minimum core dimensions shall comply with 780 CMR Table 5611.4(2) and 780 CMR Figure 5611.5. Walls shall have reinforcement in accordance with 780 CMR Table 5404.4(5).

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780 CMR TABLE 5404.4(1)
5.5-INCH THICK FLAT ICF FOUNDATION WALLS^{a,b,c,d}

HEIGHT OF BASEMENT WALL (feet)	MAXIMUM UNBALANCED BACKFILL HEIGHT ^e (feet)	MINIMUM VERTICAL REINFORCEMENT SIZE AND SPACING ^f		
		Soil group I ^f	Soil group II ^f	Soil group III ^f
8	4	#4@48"	#4@48"	#4@48"
	5	#4@48"	#3@12"; #4@22"; #5@32"	#3@8"; #4@14"; #5@20"; #6@26"
	6	#3@12"; #4@22"; #5@30"	#3@8"; #4@14"; #5@20"; #6@24"	#3@6"; #4@10"; #5@14"; #6@20"
	7	#3@8"; #4@14"; #5@22"; #6@26"	#3@5"; #4@10"; #5@14"; #6@18"	#3@4"; #4@6"; #5@ 10"; #6@14"
9	4	#4@48"	#4@48"	#4@48"
	5	#4@48"	#3@12"; #4@20"; #5@28"; #6@36"	#3@8"; #4@14"; #5@20"; #6@22"
	6	#3@10"; #4@20"; #5@28"; #6@34"	#3@6"; #4@12"; #5@18"; #6@20"	#4@8"; #5@14"; #6@16"
	7	#3@8"; #4@14"; #5@20"; #6@22"	#4@8"; #5@12"; #6@16"	#4@6"; #5@10"; #6@12"
	8	#3@6"; #4@10"; #5@14"; #6@16"	#4@6"; #5@10"; #6@12"	#4@4"; #5@6"; #6@8"
10	4	#4@48"	#4@48"	#4@48"
	5	#4@48"	#3@10"; #4@18"; #5 @26"; #6@30"	#3@6"; #4@14"; #5 @18"; #6@20"
	6	#3@10"; #4@18"; #5@24"; #6@30"	#3@6"; #4@12"; #5@16"; #6@18"	#3@4"; #4@8"; #5@12"; #6@14"
	7	#3@6"; #4@12"; #5@16"; #6@18"	#3@4"; #4@8"; #5@12"	#4@6"; #5@8"; #6@10"
	8	#4@8"; #5@12"; #6@14"	#4@6"; #5@8"; #6@ 12"	#4@4"; #5@6"; #6@8"
	9	#4@6"; #5@10"; #6@12"	#4@4"; #5@6"; #6@8"	#5@4"; #6@6"

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square inch = 6.895kPa.

- This table is based on concrete with a minimum specified concrete strength of 2500 psi, reinforcing steel with a minimum yield strength of 40,000 psi. When reinforcing steel with a minimum yield strength of 60,000 psi is used, the spacing of the reinforcement shall be increased to 1.5 times the spacing value in the table but in no case greater than 48 inches on center.
- This table is not intended to prohibit the use of an ICF manufacturer's tables based on engineering analysis in accordance with ACI 318.
- Deflection criteria: $L/240$.
- Interpolation between rebar sizes and spacing is not permitted.
- Unbalanced backfill height is the difference in height of the exterior and interior finished ground. Where an interior concrete slab is provided, the unbalanced back-fill height shall be measured from the exterior finished ground level to the top of the interior concrete slab.
- Soil classes are in accordance with the Unified Soil Classification System. Refer to 780 CMR Table 5405.1.

780 CMR TABLE 5404.4(2)
7.5-INCH THICK FLAT ICF FOUNDATION WALLS^{a,b,c,d,e}

HEIGHT OF BASEMENT WALL (feet)	MAXIMUM UNBALANCED BACKFILL HEIGHT ^f (feet)	MINIMUM VERTICAL REINFORCEMENT SIZE AND SPACING ^g		
		Soil group I ^g	Soil group II ^g	Soil group III ^g
8	6	N/R	N/R	N/R
	7	N/R	#3 @ 8"; #4 @ 14"; #5 @ 20"; #6 @ 28"	#3 @ 6"; #4 @ 10"; #5 @ 16"; #6 @ 20"
9	6	N/R	N/R	#3 @ 8"; #4 @ 14"; #5 @ 20"; #6 @ 28"
	7	N/R	#3 @ 6"; #4 @ 12"; #5 @ 18"; #6 @ 26"	#3 @ 4"; #4 @ 8"; #5 @ 14"; #6 @ 18"
	8	#3 @ 8"; #4 @ 14"; #5 @ 22"; #6 @ 28"	#3 @ 4"; #4 @ 8"; #5 @ 14"; #6 @ 18"	#3 @ 4"; #4 @ 6"; #5 @ 10"; #6 @ 14"
10	6	N/R	N/R	#3 @ 6"; #4 @ 12"; #5 @ 18"; #6 @ 26"
	7	N/R	#3 @ 6"; #4 @ 12"; #5 @ 18"; #6 @ 24"	#3 @ 4"; #4 @ 8"; #5 @ 12"; #6 @ 18"
	8	#3 @ 6"; #4 @ 12"; #5 @ 20"; #6 @ 26"	#3 @ 4"; #4 @ 8"; #5 @ 12"; #6 @ 16"	#3 @ 4"; #4 @ 6"; #5 @ 8"; #6 @ 12"
	9	#3 @ 6"; #4 @ 10"; #5 @ 14"; #6 @ 20"	#3 @ 4"; #4 @ 6"; #5 @ 10"; #6 @ 12"	#4 @ 4"; #5 @ 6"; #6 @ 10"

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square inch = 6.895kPa.

- This table is based on concrete with a minimum specified concrete strength of 2500 psi, reinforcing steel with a minimum yield strength of 40,000 psi. When reinforcing steel with a minimum yield strength of 60,000 psi is used, the spacing of the reinforcement shall be increased to 1.5 times the spacing value in the table.
- This table is not intended to prohibit the use of an ICF manufacturer's tables based on engineering analysis in accordance with ACI 318.
- N/R denotes "not required."
- Deflection criteria: $L/240$.
- Interpolation between rebar sizes and spacing is not permitted.
- Unbalanced backfill height is the difference in height of the exterior and interior finished ground. Where an interior concrete slab is provided, the unbalanced back-fill height shall be measured from the exterior finished ground level to the top of the interior concrete slab.
- Soil classes are in accordance with the Unified Soil Classification System. Refer to 780 CMR Table 5405.1.

780 CMR TABLE 5404.4(3)
9.5-INCH THICK FLAT ICF FOUNDATION WALLS^{a,b,c,d,e}

HEIGHT OF BASEMENT WALL (feet)	MAXIMUM UNBALANCED BACKFILL HEIGHT ^f (feet)	MINIMUM VERTICAL REINFORCEMENT SIZE AND SPACING ^g		
		Soil I ^g	Soil II ^g	Soil III ^g
8	7	N/R	N/R	N/R
9	6	N/R	N/R	N/R
	7	N/R	N/R	#3 @ 6"; #4 @ 12"; #5 @ 18"; #6 @ 26"
	8	N/R	#3 @ 6"; #4 @ 12"; #5 @ 18"; #6 @ 26"	#3 @ 4"; #4 @ 8"; #5 @ 14"; #6 @ 18"
10	5	N/R	N/R	N/R
	6	N/R	N/R	#3 @ 10"; #4 @ 18"; #5 @ 26"; #6 @ 36"
	7	N/R	N/R	#3 @ 6"; #4 @ 10"; #5 @ 18"; #6 @ 24"
	8	N/R	#3 @ 6"; #4 @ 12"; #5 @ 16"; #6 @ 24"	#3 @ 4"; #4 @ 8"; #5 @ 12"; #6 @ 16"
	9	N/R	#3 @ 4"; #4 @ 8"; #5 @ 12"; #6 @ 18"	#3 @ 4"; #4 @ 6"; #5 @ 10"; #6 @ 12"

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square inch = 6.895kPa.

- This table is based on concrete with a minimum specified concrete strength of 2500 psi, reinforcing steel with a minimum yield strength of 40,000 psi. When reinforcing steel with a minimum yield strength of 60,000 psi is used, the spacing of the reinforcement shall be increased to 1.5 times the spacing value in the table.
- This table is not intended to prohibit the use of an ICF manufacturer's tables based on engineering analysis in accordance with ACI 318.
- N/R denotes "not required."
- Deflection criteria: $L/240$.
- Interpolation between rebar sizes and spacing is not permitted.
- Unbalanced backfill height is the difference in height of the exterior and interior finished ground. Where an interior concrete slab is provided, the unbalanced back-fill height shall be measured from the exterior finished ground level to the top of the interior concrete slab.
- Soil classes are in accordance with the Unified Soil Classification System. Refer to 780 CMR Table 5405.1.

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780 CMR TABLE 5404.4(4)
WAFFLE GRID ICF FOUNDATION WALLS^{a,b,c,d,e}

MINIMUM NOMINAL WALL THICKNESS ^f (inches)	HEIGHT OF BASEMENT WALL (feet)	MAXIMUM UNBALANCED BACKFILL HEIGHT ^g (feet)	MINIMUM VERTICAL REINFORCEMENT SIZE AND SPACING ^h		
			Soil group I ^h	Soil group II ^h	Soil Group ^h
6	8	4	#4@48"	#3 @ 12"; #4 @ 24"	#3 @ 12"
		5	#3 @ 12"; #5 @ 24"	#4 @ 12"	#7 @ 12"
		6	#4 @ 12"	Design required	Design required
		7	#7 @ 12"	Design required	Design required
	9	4	#4@48"	#3 @ 12"; #5 @ 24"	#3 @ 12"
		5	#3 @ 12"	#4 @ 12"	Design required
		6	#5 @ 12"	Design required	Design required
		7	Design required	Design required	Design required
	10	4	#4@48"	#4 @ 12"	#5 @ 12"
		5	#3 @ 12"	Design required	Design required
		6	Design required	Design required	Design required
		7	Design required	Design required	Design required
8	8	4	N/R	N/R	N/R
		5	N/R	#3 @ 12"; #4 @ 24"; #5 @ 36"	#3 @ 12"; #5 @ 24"
		6	#3 @ 12"; #4 @ 24"; #5 @ 36"	#4 @ 12"; #5 @ 24"	#4 @ 12"
		7	#3 @ 12"; #6 @ 24"	#4 @ 12"	#5 @ 12"
	9	4	N/R	N/R	N/R
		5	N/R	#3 @ 12"; #5 @ 24"	#3 @ 12"; #5 @ 24"
		6	#3 @ 12"; #4 @ 24"	#4 @ 12"	#4 @ 12"
		7	#4 @ 12"; #5 @ 24"	#5 @ 12"	#5 @ 12"
		8	#4 @ 12"	#5 @ 12"	#8 @ 12"
	10	4	N/R	#3 @ 12"; #4 @ 24"; #6 @ 36"	#3 @ 12"; #5 @ 24"
		5	N/R	#3 @ 12"; #4 @ 24"; #6 @ 36"	#4 @ 12"; #5 @ 24"
		6	#3 @ 12"; #5 @ 24"	#4 @ 12"	#5 @ 12"
		7	#4 @ 12"	#5 @ 12"	#6 @ 12"
		8	#4 @ 12"	#6 @ 12"	Design required
		9	#5 @ 12"	Design required	Design required

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kN/m².

- This table is based on concrete with a minimum specified concrete strength of 2500 psi, reinforcing steel with a minimum yield strength of 40,000 psi. When reinforcing steel with a minimum yield strength of 60,000 psi is used, the spacing of the reinforcement shall be increased 12 inches but in no case greater than 48 inches on center.
- This table is not intended to prohibit the use of an ICF manufacturer's tables based on engineering analysis in accordance with ACI 318.
- N/R denotes "not required."
- Deflection criteria: 1/240.
- Interpolation between rebar sizes and spacing is not permitted.
- Refer to 780 CMR Table 5611.4(2) for wall dimensions.
- Unbalanced backfill height is the difference in height of the exterior and interior finished ground. Where an interior concrete slab is provided, the unbalanced back-fill height shall be measured from the exterior finished ground level to the top of the interior concrete slab.
- Soil classes are in accordance with the Unified Soil Classification System. Refer to 780 CMR Table 5405.1.

780 CMR TABLE 5404.4(5)
SCREEN-GRID ICF FOUNDATION WALLS^{a,b,c,d,e}

MINIMUM NOMINAL WALL THICKNESS ^c (inches)	MAXIMUM WALL HEIGHT (feet)	MAXIMUM UNBALANCED BACKFILL HEIGHT ^e (feet)	MINIMUM VERTICAL REINFORCEMENT SIZE AND SPACING		
			Soil classes		
			Soil group I ^h	Soil group II ^h	Soil group III ^h
6	8	4	#4@48"	#3@12"; #4@24"; #5@36"	#3@12"; #5@24"
		5	#3 @12"; #4@24"	#3 @12"	#4 @12"
		6	#4@12"	#5@12"	Design required
		7	#4@12"	Design required	Design required
	9	4	#4@48"	#3@12"; #4@24"	#3@12"; #6@24"
		5	#3 @12"; #5 @24"	#4 @12"	#7 @12"
		6	#4@12"	Design required	Design required
		7	Design required	Design required	Design required
		8	Design required	Design required	Design required
	10	4	#4@48"	#3@12"; #5@24"	#3@12"
		5	#3 @12"	#4 @12"	#7 @12"
		6	#4@12"	Design required	Design required
		7	Design required	Design required	Design required
		8	Design required	Design required	Design required

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kN/m².

- This table is based on concrete with a minimum specified concrete strength of 2500 psi, reinforcing steel with a minimum yield strength of 40,000 psi. When reinforcing steel with a minimum yield strength of 60,000 psi is used, the spacing of the reinforcement in the shaded cells shall be increased 12 inches.
- This table is not intended to prohibit the use of an ICF manufacturer's tables based on engineering analysis in accordance with ACI 318.
- N/R denotes "not required."
- Deflection criteria: 1/240.
- Interpolation between rebar sizes and spacing is not permitted.
- Refer to 780 CMR Table 5611.4(2) for wall dimensions.
- Unbalanced backfill height is the difference in height of the exterior and interior finished ground. Where an interior concrete slab is provided, the unbalanced back-fill height shall be measured from the exterior finished ground level to the top of the interior concrete slab.
- Soil classes are in accordance with the Unified Soil Classification System. Refer to 780 CMR Table 5405.1.

5404.4.5 Concrete Material. Ready-mixed concrete for insulating concrete form walls shall be in accordance with 780 CMR 5402.2. Maximum slump shall not be greater than six inches (152 mm) as determined in accordance with ASTM C 143. Maximum aggregate size shall not be larger than ¾ inch (19.1 mm).

Exception: Concrete mixes conforming to the ICF manufacturer's recommendations.

5404.4.6 Reinforcing Steel.

5404.4.6.1 General. Reinforcing steel shall meet the requirements of ASTM A 615, A 706 or A 996. The minimum yield strength of reinforcing steel shall be 40,000 psi (Grade 40) (276 MPa). Vertical and horizontal wall reinforcements shall be placed no closer to the outside face of the wall than one-half the wall thickness. Steel reinforcement for foundation walls shall have concrete cover in accordance with ACI 318.

Exception: Where insulated concrete forms are used and the form remains in place as cover for the concrete, the minimum concrete cover for the reinforcing steel is permitted to be reduced to ¾ inch (19.1 mm).

5404.4.6.2 Horizontal Reinforcement. When vertical reinforcement is required, ICF foundation walls shall have horizontal reinforcement in accordance with 780 CMR 5404.4.6.2. ICF foundation walls up to eight feet (2438 mm) in height shall have a minimum of one continuous No. 4 horizontal reinforcing bar placed at 48 inches (1219mm) on center with one bar located within 12 inches (305 mm) of the top of the wall story. ICF Foundation walls greater than eight feet (2438 mm) in height shall have a minimum of one continuous No. 4 horizontal reinforcing bar placed at 36 inches (914 mm) on center with one bar located within 12 inches (305 mm) of the top of the wall story.

5404.4.6.3 Wall Openings. Vertical wall reinforcement required by 780 CMR 5404.4.2, 5404.4.3 or 5404.4.4 that is interrupted by wall openings shall have additional vertical reinforcement of the same size placed within 12 inches (305 mm) of each side of the opening.

5404.4.7 Foam Plastic Insulation. Foam plastic insulation in insulating concrete foam

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construction shall comply with 780 CMR 5404.

5404.4.7.1 Material. Insulating concrete form material shall meet the surface burning characteristics of 780 CMR 5314.1.1. A thermal barrier shall be provided on the building interior in accordance with 780 CMR 5314.1.2.

5404.4.7.2 Termite Hazards. In areas where hazard of termite damage is very heavy in accordance with 780 CMR Figure 5301.2(6), foam plastic insulation shall be permitted below grade on foundation walls in accordance with one of the following conditions:

1. When in addition to the requirements in 780 CMR 5320.1, an approved method of protecting the foam plastic and structure from subterranean termite damage is provided.
2. The structural members of walls, floors, ceilings and roofs are entirely of noncombustible materials or pressure preservatively treated wood.
3. On the interior side of basement walls.

5404.4.8 Foundation Wall Thickness Based on Walls Supported. The thickness of ICF foundation walls shall not be less than the thickness of the wall supported above.

5404.4.9 Height above Finished Ground. ICF foundation walls shall extend above the finished ground adjacent to the foundation at all points a minimum of four inches (102 mm) where masonry veneer is used and a minimum of six inches (152 mm) elsewhere.

5404.4.10 Backfill Placement. Backfill shall be placed in accordance with 780 CMR 5404.1.7.

5404.4.11 Drainage and dampproofing/Waterproofing. ICF foundation basements shall be drained and dampproofed/waterproofed in accordance with 780 CMR 5405 and 5406.

780 CMR 5405 FOUNDATION DRAINAGE

5405.1 Concrete or Masonry Foundations. Drains shall be provided around all concrete or masonry foundations that retain earth and enclose habitable or

usable spaces located below grade. Drainage tiles, gravel or crushed stone drains, perforated pipe or other approved systems or materials shall be installed at or below the area to be protected and shall discharge by gravity or mechanical means into an approved drainage system. Gravel or crushed stone drains shall extend at least one foot (305 mm) beyond the outside edge of the footing and six inches (153 mm) above the top of the footing and be covered with an approved filter membrane material. The top of open joints of drain tiles shall be protected with strips of building paper, and the drainage tiles or perforated pipe shall be placed on a minimum of two inches (51 mm) of washed gravel or crushed rock at least one sieve size larger than the tile joint opening or perforation and covered with not less than six inches (153 mm) of the same material.

Exception: A drainage system is not required when the foundation is installed on well-drained ground or sand-gravel mixture soils according to the Unified Soil Classification System, Group I Soils, as detailed in 780 CMR Table 5405.1.

5405.2 Wood Foundations. Wood foundations enclosing habitable or usable spaces located below grade shall be adequately drained in accordance with 780 CMR 5405.2.1 through 5405.2.3.

5405.2.1 Base. A porous layer of gravel, crushed stone or coarse sand shall be placed to a minimum thickness of four inches (102 mm) under the basement floor. Provision shall be made for automatic draining of this layer and the gravel or crushed stone wall footings.

5405.2.2 Moisture Barrier. A six-mil-thick (0.15 mm) polyethylene moisture barrier shall be applied over the porous layer with the basement floor constructed over the polyethylene.

5405.2.3 Drainage System. In other than Group I soils, a sump shall be provided to drain the porous layer and footings. The sump shall be at least 24 inches (610 mm) in diameter or 20 inches square (0.0 129 m²), shall extend at least 24 inches (610 mm) below the bottom of the basement floor and shall be capable of positive gravity or mechanical drainage to remove any accumulated water. The drainage system shall discharge into an approved sewer system or to daylight.

FOUNDATIONS FOR SINGLE- AND TWO-FAMILY DWELLINGS

780 CMR TABLE 5405.1
PROPERTIES OF SOILS CLASSIFIED ACCORDING TO THE UNIFIED SOIL
CLASSIFICATION SYSTEM

SOIL GROUP	UNIFIED SOIL CLASSIFICATION SYSTEM SYMBOL	SOIL DESCRIPTION	DRAINAGE CHARACTERISTICS ^a	FROST HEAVE POTENTIAL	VOLUME CHANGE POTENTIAL EXPANSION ^b
Group I	GW	Well-graded gravels, gravel sand mixtures, little or no fines.	Good	Low	Low
	GP	Poorly graded gravels or gravel sand mixtures, little or no fines.	Good	Low	Low
	SW	Well-graded sands, gravelly sands, little or no fines.	Good	Low	Low
	SP	Poorly graded sands or gravelly sands, little or no fines.	Good	Low	Low
	GM	Silty gravels, gravel-sand-silt mixtures.	Good	Medium	Low
	SM	Silty sand, sand-silt mixtures.	Good	Medium	Low
Group II	GC	Clayey gravels, gravel-sand-clay mixtures.	Medium	Medium	Low
	SC	Clayey sands, sand-clay mixture.	Medium	Medium	Low
	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.	Medium	High	Low
	CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.	Medium	Medium	Medium to Low
Group III _M	CH	Inorganic clays of high plasticity, fat clays.	Poor	Medium	High
		Inorganic silts, micaceous or diatomaceous ^{fine} sandy or silty soils, elastic silts.	Poor	High	High
Group IV	OL	Organic silts and organic silty clays of low plasticity.	Poor	Medium	Medium
	OH	Organic clays of medium to high plasticity, organic silts.	Unsatisfactory	Medium	High
	Pt	Peat and other highly organic soils.	Unsatisfactory	Medium	High

For SI: 1 inch = 25.4 mm.

- a. The percolation rate for good drainage is over 4 inches per hour, medium drainage is 2 inches to 4 inches per hour, and poor is less than 2 inches per hour.
- b. Soils with a low potential expansion typically have a plasticity index (PI) of 0 to 15, soils with a medium potential expansion have a PI of 10 to 35 and soils with a high potential expansion have a PI greater than 20.

780 CMR 5406 FOUNDATION WATERPROOFING AND DAMPPROOFING

5406.1 Concrete and Masonry Foundation Dampproofing. Except where required to be waterproofed by 780 CMR 5406.2, foundation walls that retain earth and enclose habitable or usable spaces located below grade shall be dampproofed from the top of the footing to the finished grade. Masonry *foundation* walls shall have not less than $\frac{3}{8}$ inch (9.5 mm) portland cement parging applied to the exterior of the wall. The parging shall be damp-proofed with a bituminous coating, three pounds per square yard (1.63 kg/m²) of acrylic modified cement, $\frac{1}{8}$ -inch (3.2 mm) coat of surface-bonding mortar complying with ASTM C 887 or any material permitted for waterproofing in 780 CMR 5406.2. Concrete *foundation* walls shall be dampproofed by applying any one of the above listed dampproofing materials or any one of the waterproofing materials listed in 780 CMR 5406.2 to the exterior of the wall.

5406.2 Concrete and Masonry Foundation Waterproofing. In areas where a high water table or other severe soil-water conditions are known to exist, exterior foundation walls that retain earth and enclose habitable or usable spaces located below grade shall be waterproofed with a membrane extending from the top of the footing to the finished grade. The membrane shall consist of two-ply hot-mopped felts, 55 pound (25 kg) roll roofing, six-mil (0.15 mm) polyvinyl chloride, six-mil (0.15 mm) polyethylene or 40-mil (1 mm) polymer-modified asphalt. The joints in the membrane shall be lapped and sealed with an adhesive compatible with the waterproofing membrane.

Exception: Organic solvent based products such as hydrocarbons, chlorinated hydrocarbons, ketones and esters shall not be used for ICF walls with expanded polystyrene form material. Plastic roofing cements, acrylic coatings, latex coatings, mortars and pargings are permitted to be used to seal ICF walls. Cold setting asphalt or hot asphalt shall conform to type C of ASTM D 449. Hot

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asphalt shall be applied at a temperature of less than 200°.

Through-wall formwork ties shall be removed from both faces of the foundation wall which enclose basements, cellars, below-grade garages or any space having the potential to be converted to useable or occupiable space and patched with hydraulic cement.

5406.3 Dampproofing for Wood Foundations. Wood foundations enclosing habitable or usable spaces located below grade shall be dampproofed in accordance with 780 CMR 5406.3.1 through 5406.3.4.

5406.3.1 Panel Joint Sealed. Plywood panel joints in the foundation walls shall be sealed full length with a caulking compound capable of producing a moisture-proof seal under the conditions of temperature and moisture content at which it will be applied and used.

5406.3.2 Below grade moisture barrier. A six-mil-thick (0.15 mm) polyethylene film shall be applied over the below-grade portion of exterior foundation walls prior to backfilling. Joints in the polyethylene film shall be lapped six inches (152 mm) and sealed with adhesive. The top edge of the polyethylene film shall be bonded to the sheathing to form a seal. Film areas at grade level shall be protected from mechanical damage and exposure by a pressure preservatively treated lumber or plywood strip attached to the wall several inches above finish grade level and extending approximately nine inches (229 mm) below grade. The joint between the strip and the wall shall be caulked full length prior to fastening the strip to the wall. Other coverings appropriate to the architectural treatment may also be used. The polyethylene film shall extend down to the bottom of the wood footing plate but shall not overlap or extend into the gravel or crushed stone footing.

5406.3.3 Porous Fill. The space between the excavation and the foundation wall shall be backfilled with the same material used for footings, up to a height of one foot (305 mm) above the footing for well-drained sites, or **Chap.** ½ the total back-fill height for poorly drained sites. The porous fill shall be covered with strips of 30-pound (13.6 kg) asphalt paper or six-mil (0.15 mm) polyethylene to permit water seepage while avoiding infiltration of fine soils.

5406.3.4 Backfill. The remainder of the excavated area shall be backfilled with the same type of soil as was removed during the excavation.

780 CMR 5407 COLUMNS

5407.1 Wood Column Protection. Wood columns shall be protected against decay as set forth in

780 CMR 5319.

5407.2 Steel Column Protection. All surfaces (inside and outside) of steel columns shall be given a shop coat of rust-inhibitive paint, except for corrosion-resistant steel and steel treated with coatings to provide corrosion resistance.

5407.3 Structural Requirements. Columns shall be restrained to prevent lateral displacement at the bottom *and top* end. Wood columns shall not be less in nominal size than four inches by four inches (102 mm by 102 mm) and steel columns shall not be less than three-inch-diameter (76 mm) standard *weight* pipe or approved equivalent.

780 CMR 5408 UNDER-FLOOR SPACE

5408.1 Ventilation. The under-floor space between the bottom of the floor joists and the earth under any building (except space occupied by a basement or cellar) shall be provided with ventilation openings through foundation walls or exterior walls. The minimum net area of ventilation openings shall not be less than 1 square foot for each 150 square feet (0.67 m² for each 100 m²) of under-floor space area. One such ventilating opening shall be within three feet (914 mm) of each corner of said building.

5408.2 Openings for Under-floor Ventilation. The minimum net area of ventilation openings shall not be less than 1 square foot (0.0929 m²) for each 150 square feet (100 m²) of underfloor space area. One such ventilating opening shall be within three feet (914 mm) of each corner of the building. Ventilation openings shall be covered for their height and width with any of the following materials provided that the least dimension of the covering shall not exceed ¼ inch (6.4 mm):

1. Perforated sheet metal plates not less than 0.070 inch (1.8 mm) thick.
2. Expanded sheet metal plates not less than 0.047 inch (1.2 mm) thick.
3. Cast iron grills or grating.
4. Extruded load-bearing brick vents.
5. Hardware cloth of 0.035 inch (0.89 mm) wire or heavier.
6. Corrosion-resistant wire mesh, with the least dimension being ⅛ inch (3.2 mm).

Exceptions:

1. Where warranted by climatic conditions, ventilation openings to the outdoors are not required if ventilation openings to the interior are provided.
2. The total area of ventilation openings may be reduced to 1/1500 of the under-floor area where the ground surface is treated with an approved vapor retarder material and the required openings are placed so as to provide cross-ventilation of the space. The installation of operable louvers shall not be prohibited.

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3. Under-floor spaces used as supply plenums for distribution of heated and cooled air shall comply with the requirements of 780 CMR 6601.4.

4. Ventilation openings are not required where continuously operated mechanical ventilation is provided at a rate of 1.0 cfm (10 m³) for each 50 square feet (1.02 L/s) of underfloor space floor area and ground surface is covered with an approved vapor retarder material.

5. Ventilation openings are not required when the ground surface is covered with an approved vapor retarder material, the space is supplied with conditioned air and the perimeter walls are insulated in accordance with 780 CMR 6102.1.7.

5408.3 Access. Access shall be provided to all under-floor spaces. Access openings through the floor shall be a minimum of 18 inches by 24 inches (457 mm × 610 mm). Openings through a perimeter wall shall be 16 inches by 24 inches (407 mm × 610 mm). When any portion of the through wall access is below grade, an areaway of not less than 16 inches by 24 inches shall be provided. The bottom of the areaway shall be below the threshold of the access opening. Through wall access openings shall not be located under a door to the residence. See 780 CMR 6305.1.4 for access requirements where mechanical equipment is located under floors.

5408.4 Removal of Debris. The under-floor grade shall be cleaned of all vegetation and organic material. All wood forms used for placing concrete shall be removed before a building is occupied or used for any purpose. All construction materials shall be removed before a building is occupied or used for any purpose.

5408.5 Finished Grade. The finished grade of under-floor surface may be located at the bottom of the footings; however, where there is evidence that the groundwater table can rise to within six inches (152 mm) of the finished floor at the building perimeter or where there is evidence that the surface water does not readily drain from the building site, the grade in the under-floor space shall be as high as the outside finished grade, unless an approved drainage system is provided.

5408.6 Flood Resistance. For buildings located in areas prone to flooding as established *by the community Flood Insurance Rate Maps (FIRM)*.

1. Walls enclosing the underfloor space shall be provided with flood openings in accordance with 780 CMR 5323.2.2.

2. The finished ground level of the underfloor space shall be equal to or higher than the outside finished ground level.

Exception: Underfloor spaces that meet the requirements of FEMA/FIA TB 11-1.

FLOORS

780 CMR 5501 GENERAL

5501.1 Application. The provisions of 780 CMR 55.00 shall control the design and construction of the floors for all buildings including the floors of attic spaces used to house mechanical and/or plumbing fixtures and equipment.

5501.2 Requirements. Floor construction shall be capable of accommodating all loads according to 780 CMR 5301 and of transmitting the resulting loads to the supporting structural elements.

780 CMR 5502 WOOD FLOOR FRAMING

5502.1 Identification. Load-bearing dimension lumber for joists, beams and girders shall be identified by a grade mark of a lumber grading or inspection agency that has been approved by an accreditation body that complies with DOC PS 20. In lieu of a grade mark, a certificate of inspection issued by a lumber grading or inspection agency meeting the requirements of 780CMR 5502 shall be accepted.

5502.1.1 Preservatively Treated Lumber. Preservatively treated dimension lumber shall also be identified as required by 780 CMR 5319.1.

5502.1.2 Blocking and Subflooring. Blocking shall be a minimum of utility grade lumber. Subflooring may be a minimum of utility grade lumber or No. 4 common grade boards.

5502.1.3 End-jointed Lumber. Approved end-jointed lumber identified by a grade mark conforming to 780 CMR 5501.2 may be used interchangeably with solid-sawn members of the same species and grade.

5502.1.4 Prefabricated Wood I-joists. Structural capacities and design provisions for prefabricated wood I-joists shall be established and monitored in accordance with ASTM D 5055.

5502.1.5 Structural Glued Laminated Timbers. Glued laminated timbers shall be manufactured and identified as required in AITC A190.1 and ASTM D3737.

5502.2 Design and Construction. Floors shall be designed and constructed in accordance with the provisions of 780 CMR 55.00, 780 CMR Figure 5502.2 and 780 CMR 5319 and 5320 or in accordance with AF&PA/NDS.

5502.2.1 Decks. Where supported by attachment to an exterior wall, decks shall be positively anchored to the primary structure and designed for both vertical and lateral loads as applicable. Such attachment shall not be accomplished by the use of toenails or nails subject to withdrawal. Where

positive connection to the primary building structure cannot be verified during inspection, decks shall be self-supporting. For decks with cantilevered framing members, connections to exterior walls or other framing members, shall be designed and constructed to resist uplift resulting from the full live load specified in 780 CMR Table 5301.5 acting on the cantilevered portion of the deck *and no live load on the interior span*.

5502.3 Allowable Joist Spans. Spans for floor joists shall be in accordance with 780 CMR Tables 5502.3.1(1) and 5502.3.1(2). For other grades and species and for other loading conditions, refer to the AF&PA Span Tables for Joists and Rafters, or the AF&PA Maximum Span Calculator for Joists & Rafters.

5502.3.1 Sleeping Areas and Attic Joists. 780 CMR Table 5502.3.1(1) shall be utilized to determine the maximum allowable span of floor joists that support sleeping areas and attics that are accessed by means of a fixed stairway provided that the design live load does not exceed 30 psf (1.44 kN/m²) and the design dead load does not exceed 10 psf (0.48 kN/m²). The allowable span of ceiling joists that support attics utilized for limited storage or no storage shall be determined in accordance with 780 CMR 5802.4.

5502.3.2 Other Floor Joists. 780 CMR Table 5502.3.1(2) shall be utilized to determine the maximum allowable span of floor joists that support all areas of the building, other than sleeping and attics, provided that the design live load does not exceed 40 psf (1.92 kN/m²) and the design dead does not exceed ten psf (0.48 kN/m²).

5502.3.3 Floor Cantilevers. Floor cantilever spans shall not exceed the nominal depth of the wood floor joist. Floor cantilevers constructed in accordance with 780 CMR Table 5502.3.3(1) shall be permitted when supporting a light-frame bearing wall and roof only. Floor cantilevers supporting an exterior balcony are permitted to be constructed in accordance with 780 CMR Table 5502.3.3(2).

5502.4 Joists under Bearing Partitions. Joists under parallel bearing partitions shall be of adequate size to support the load. Double joists, sized to adequately support the load, that are separated to permit the installation of piping or vents shall be full depth solid blocked with lumber not less than two inches (51 mm) in nominal thickness spaced not more than four feet (1219 mm) on center. Bearing partitions perpendicular to joists shall not be offset from supporting girders, walls or partitions more than

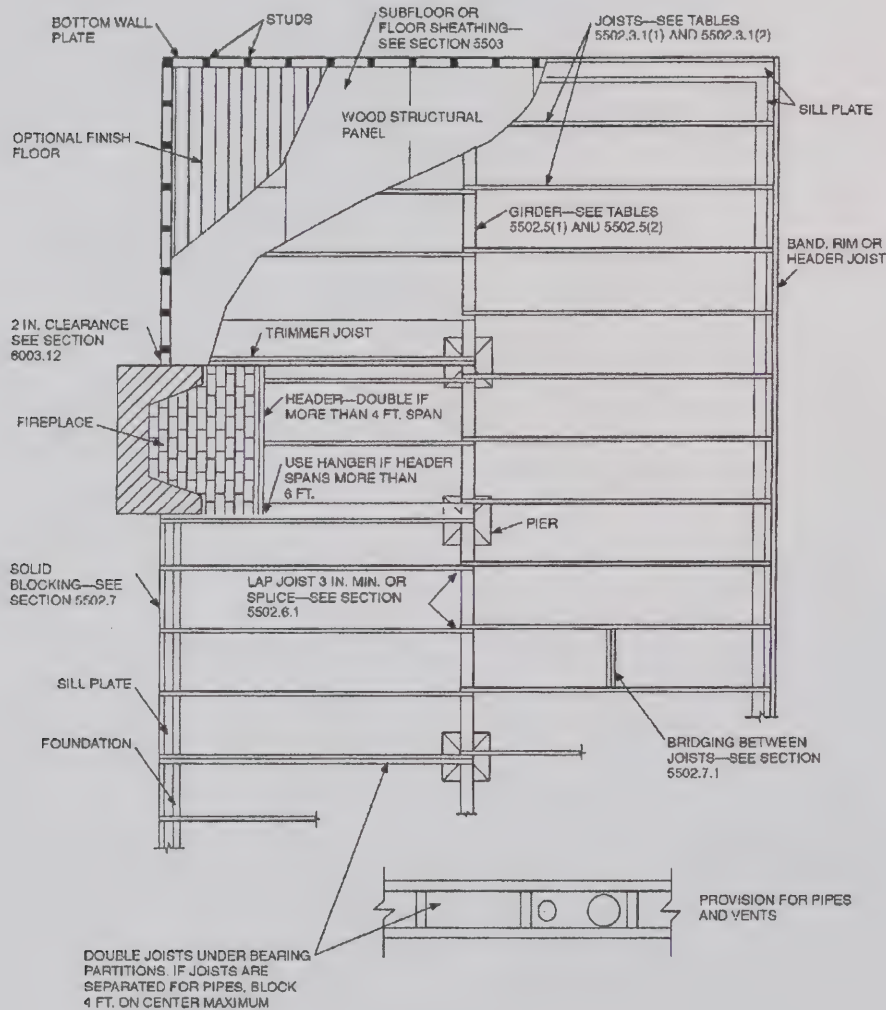
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the joist depth unless such joists are of sufficient size to carry the additional load.

shall not exceed the values set forth in 780 CMR Tables 5502.5(1) and 5502.5(2).

5502.5 Allowable Girder Spans. The allowable spans of girders fabricated of dimension lumber

**780 CMR FIGURE 5502.2
FLOOR CONSTRUCTION**



For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

780 CMR TABLE 5502.3.1(1)
FLOOR JOIST SPANS FOR COMMON LUMBER SPECIES
 (Residential Sleeping Areas, Live Load = 30 psf, L/Δ = 360)

JOIST SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf				DEAD LOAD = 20 psf			
			2x6	2x8	2x10	2x12	2x6	2x8	2x10	2x12
			Maximum floor joist spans							
			(ft.- in.)	(ft.- in.)	(ft.- in.)	(ft.- in.)	(ft.- in.)	(ft.- in.)	(ft.- in.)	(ft.- in.)
12	Douglas fir-larch	SS	12- 6	16- 6	21- 0	25- 7	12- 6	16- 6	21- 0	25- 7
	Douglas fir-larch	#1	12- 0	15-10	20- 3	24- 8	12- 0	15- 7	19- 0	22- 0
	Douglas fir-larch	#2	11-10	15- 7	19-10	23- 0	11- 6	14- 7	17- 9	20- 7
	Douglas fir-larch	#3	9- 8	12- 4	15- 0	17- 5	8- 8	11- 0	13- 5	15- 7
	Hem-fir	SS	11-10	15- 7	19-10	24- 2	11-10	15- 7	19-10	24- 2
	Hem-fir	#1	11- 7	15- 3	19- 5	23- 7	11- 7	15- 2	18- 6	21- 6
	Hem-fir	#2	11- 0	14- 6	18- 6	22- 6	11- 0	14- 4	17- 6	20- 4
	Hem-fir	#3	9- 8	12- 4	15- 0	17- 5	8- 8	11- 0	13- 5	15- 7
	Southern pine	SS	12- 3	16- 2	20- 8	25- 1	12- 3	16- 2	20- 8	25- 1
	Southern pine	#1	12- 0	15-10	20- 3	24- 8	12- 0	15-10	20- 3	24- 8
	Southern pine	#2	11-10	15- 7	19-10	24- 2	11-10	15- 7	18- 7	21- 9
	Southern pine	#3	10- 5	13- 3	15- 8	18- 8	9- 4	11-11	14- 0	16- 8
	Spruce-pine-fir	SS	11- 7	15- 3	19- 5	23- 7	11- 7	15- 3	19- 5	23- 7
	Spruce-pine-fir	#1	11- 3	14-11	19- 0	23- 0	11- 3	14- 7	17- 9	20- 7
	Spruce-pine-fir	#2	11- 3	14-11	19- 0	23- 0	11- 3	14- 7	17- 9	20- 7
	Spruce-pine-fir	#3	9- 8	12- 4	15- 0	17- 5	8- 8	11- 0	13- 5	15- 7
16	Douglas fir-larch	SS	11- 4	15- 0	19- 1	23- 3	11- 4	15- 0	19- 1	23- 0
	Douglas fir-larch	#1	10-11	14- 5	18- 5	21- 4	10- 8	13- 6	16- 5	19- 1
	Douglas fir-larch	#2	10- 9	14- 1	17- 2	19-11	9-11	12- 7	15- 5	17-10
	Douglas fir-larch	#3	8- 5	10- 8	13- 0	15- 1	7- 6	9- 6	11- 8	13- 6
	Hem-fir	SS	10- 9	14- 2	18- 0	21-11	10- 9	14- 2	18- 0	21-11
	Hem-fir	#1	10- 6	13-10	17- 8	20- 9	10- 4	13- 1	16- 0	18- 7
	Hem-fir	#2	10- 0	13- 2	16-10	19- 8	9-10	12- 5	15- 2	17- 7
	Hem-fir	#3	8- 5	10- 8	13- 0	15- 1	7- 6	9- 6	11- 8	13- 6
	Southern pine	SS	11- 2	14- 8	18- 9	22-10	11- 2	14- 8	18- 9	22-10
	Southern pine	#1	10-11	14- 5	18- 5	22- 5	10-11	14- 5	17-11	21- 4
	Southern pine	#2	10- 9	14- 2	18- 0	21- 1	10- 5	13- 6	16- 1	18-10
	Southern pine	#3	9- 0	11- 6	13- 7	16- 2	8- 1	10- 3	12- 2	14- 6
	Spruce-pine-fir	SS	10- 6	13-10	17- 8	21- 6	10- 6	13-10	17- 8	21- 4
	Spruce-pine-fir	#1	10- 3	13- 6	17- 2	19-11	9-11	12- 7	15- 5	17-10
	Spruce-pine-fir	#2	10- 3	13- 6	17- 2	19-11	9-11	12- 7	15- 5	17-10
	Spruce-pine-fir	#3	8- 5	10- 8	13- 0	15- 1	7- 6	9- 6	11- 8	13- 6
19.2	Douglas fir-larch	SS	10- 8	14- 1	18- 0	21-10	10- 8	14- 1	18- 0	21- 0
	Douglas fir-larch	#1	10- 4	13- 7	16- 9	19- 6	9- 8	12- 4	15- 0	17- 5
	Douglas fir-larch	#2	10- 1	12-10	15- 8	18- 3	9- 1	11- 6	14- 1	16- 3
	Douglas fir-larch	#3	7- 8	9- 9	11-10	13- 9	6-10	8- 8	10- 7	12- 4
	Hem-fir	SS	10- 1	13- 4	17- 0	20- 8	10- 1	13- 4	17- 0	20- 7
	Hem-fir	#1	9-10	13- 0	16- 4	19- 0	9- 6	12- 0	14- 8	17- 0
	Hem-fir	#2	9- 5	12- 5	15- 6	17- 1	8-11	11- 4	13-10	16- 1
	Hem-fir	#3	7- 8	9- 9	11-10	13- 9	6-10	8- 8	10- 7	12- 4
	Southern pine	SS	10- 6	13-10	17- 8	21- 6	10- 6	13-10	17- 8	21- 6
	Southern pine	#1	10- 4	13- 7	17- 4	21- 1	10- 4	13- 7	16- 4	19- 6
	Southern pine	#2	10- 1	13- 4	16- 5	19- 3	9- 6	12- 4	14- 8	17- 2
	Southern pine	#3	8- 3	10- 6	12- 5	14- 9	7- 4	9- 5	11- 1	13- 2
	Spruce-pine-fir	SS	9-10	13- 0	16- 7	20- 2	9-10	13- 0	16- 7	19- 6
	Spruce-pine-fir	#1	9- 8	12- 9	15- 8	18- 3	9- 1	11- 6	14- 1	16- 3
	Spruce-pine-fir	#2	9- 8	12- 9	15- 8	18- 3	9- 1	11- 6	14- 1	16- 3
	Spruce-pine-fir	#3	7- 8	9- 9	11-10	13- 9	6-10	8- 8	10- 7	12- 4
24	Douglas fir-larch	SS	9-11	13- 1	16- 8	20- 3	9-11	13- 1	16- 2	18- 9
	Douglas fir-larch	#1	9- 7	12- 4	15- 0	17- 5	8- 8	11- 0	13- 5	15- 7
	Douglas fir-larch	#2	9- 1	11- 6	14- 1	16- 3	8- 1	10- 3	12- 7	14- 7
	Douglas fir-larch	#3	6-10	8- 8	10- 7	12- 4	6- 2	7- 9	9- 6	11- 0
	Hem-fir	SS	9- 4	12- 4	15- 9	19- 2	9- 4	12- 4	15- 9	18- 5
	Hem-fir	#1	9- 2	12- 0	14- 8	17- 0	8- 6	10- 9	13- 1	15- 2
	Hem-fir	#2	8- 9	11- 4	13-10	16- 1	8- 0	10- 2	12- 5	14- 4
	Hem-fir	#3	6-10	8- 8	10- 7	12- 4	6- 2	7- 9	9- 6	11- 0
	Southern pine	SS	9- 9	12-10	16- 5	19-11	9- 9	12-10	16- 5	19-11
	Southern pine	#1	9- 7	12- 7	16- 1	19- 6	9- 7	12- 4	14- 7	17- 5
	Southern pine	#2	9- 4	12- 4	14- 8	17- 2	8- 6	11- 0	13- 1	15- 5
	Southern pine	#3	7- 4	9- 5	11- 1	13- 2	6- 7	8- 5	9-11	11-10
	Spruce-pine-fir	SS	9- 2	12- 1	15- 5	18- 9	9- 2	12- 1	15- 0	17- 5
	Spruce-pine-fir	#1	8-11	11- 6	14- 1	16- 3	8- 1	10- 3	12- 7	14- 7
	Spruce-pine-fir	#2	8-11	11- 6	14- 1	16- 3	8- 1	10- 3	12- 7	14- 7
	Spruce-pine-fir	#3	6-10	8- 8	10- 7	12- 4	6- 2	7- 9	9- 6	11- 0

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kN/m². NOTE: Check sources for availability of lumber in lengths greater than 20 feet.

THE MASSACHUSETTS STATE BUILDING CODE

780 CMR TABLE 5502.3.1(2)
FLOOR JOIST SPANS FOR COMMON LUMBER SPECIES
 (Residential living areas, live load = 40 psf, $L/\Delta = 360$)

JOIST SPACING (inches)	SPECIES AND GRADE	DEAD LOAD = 10 psf				DEAD LOAD = 20 psf			
		2x6	2x8	2x10	2x12	2x6	2x8	2x10	2x12
		Maximum floor joist spans							
		(ft.-in.)	(ft.-in.)	(ft.-in.)	(ft.-in.)	(ft.-in.)	(ft.-in.)	(ft.-in.)	(ft.-in.)
12	Douglas fir-larch SS	11-4	15-0	19-1	23-3	11-4	15-0	19-1	23-3
	Douglas fir-larch #1	10-11	14-5	18-5	22-0	10-11	14-2	17-4	20-1
	Douglas fir-larch #2	10-9	14-2	17-9	20-7	10-6	13-3	16-3	18-10
	Douglas fir-larch #3	8-8	11-0	13-5	15-7	7-11	10-0	12-3	14-3
	Hem-fir SS	10-9	14-2	18-0	21-11	10-9	14-2	18-0	21-11
	Hem-fir #1	10-6	13-10	17-8	21-6	10-6	13-10	16-11	19-7
	Hem-fir #2	10-0	13-2	16-10	20-4	10-0	13-1	16-0	18-6
	Hem-fir #3	8-8	11-0	13-5	15-7	7-11	10-0	12-3	14-3
	Southern pine SS	11-2	14-8	18-9	22-10	11-2	14-8	18-9	22-10
	Southern pine #1	10-11	14-5	18-5	22-5	10-11	14-5	18-5	22-5
	Southern pine #2	10-9	14-2	18-0	21-9	10-9	14-2	16-11	19-10
	Southern pine #3	9-4	11-11	14-0	16-8	8-6	10-10	12-10	15-3
	Spruce-pine-fir SS	10-6	13-10	17-8	21-6	10-6	13-10	17-8	21-6
	Spruce-pine-fir #1	10-3	13-6	17-3	20-7	10-3	13-3	16-3	18-10
	Spruce-pine-fir #2	10-3	13-6	17-3	20-7	10-3	13-3	16-3	18-10
	Spruce-pine-fir #3	8-8	11-0	13-5	15-7	7-11	10-0	12-3	14-3
16	Douglas fir-larch SS	10-4	13-7	17-4	21-1	10-4	13-7	17-4	21-0
	Douglas fir-larch #1	9-11	13-1	16-5	19-1	9-8	12-4	15-0	17-5
	Douglas fir-larch #2	9-9	12-7	15-5	17-10	9-1	11-6	14-1	16-3
	Douglas fir-larch #3	7-6	9-6	11-8	13-6	6-10	8-8	10-7	12-4
	Hem-fir SS	9-9	12-10	16-5	19-11	9-9	12-10	16-5	19-11
	Hem-fir #1	9-6	12-7	16-0	18-7	9-6	12-0	14-8	17-0
	Hem-fir #2	9-1	12-0	15-2	17-7	8-11	11-4	13-10	16-1
	Hem-fir #3	7-6	9-6	11-8	13-6	6-10	8-8	10-7	12-4
	Southern pine SS	10-2	13-4	17-0	20-9	10-2	13-4	17-0	20-9
	Southern pine #1	9-11	13-1	16-9	20-4	9-11	13-1	16-4	19-6
	Southern pine #2	9-9	12-10	16-1	18-10	9-6	12-4	14-8	17-2
	Southern pine #3	8-1	10-3	12-2	14-6	7-4	9-5	11-1	13-2
	Spruce-pine-fir SS	9-6	12-7	16-0	19-6	9-6	12-7	16-0	19-6
	Spruce-pine-fir #1	9-4	12-3	15-5	17-10	9-1	11-6	14-1	16-3
	Spruce-pine-fir #2	9-4	12-3	15-5	17-10	9-1	11-6	14-1	16-3
	Spruce-pine-fir #3	7-6	9-6	11-8	13-6	6-10	8-8	10-7	12-4
19.2	Douglas fir-larch SS	9-8	12-10	16-4	19-10	9-8	12-10	16-4	19-2
	Douglas fir-larch #1	9-4	12-4	15-0	17-5	8-10	11-3	13-8	15-11
	Douglas fir-larch #2	9-1	11-6	14-1	16-3	8-3	10-6	12-10	14-10
	Douglas fir-larch #3	6-10	8-8	10-7	12-4	6-3	7-11	9-8	11-3
	Hem-fir SS	9-2	12-1	15-5	18-9	9-2	12-1	15-5	18-9
	Hem-fir #1	9-0	11-10	14-8	17-0	8-8	10-11	13-4	15-6
	Hem-fir #2	8-7	11-3	13-10	16-1	8-2	10-4	12-8	14-8
	Hem-fir #3	6-10	8-8	10-7	12-4	6-3	7-11	9-8	11-3
	Southern pine SS	9-6	12-7	16-0	19-6	9-6	12-7	16-0	19-6
	Southern pine #1	9-4	12-4	15-9	19-2	9-4	12-4	14-11	17-9
	Southern pine #2	9-2	12-1	14-8	17-2	8-8	11-3	13-5	15-8
	Southern pine #3	7-4	9-5	11-1	13-2	6-9	8-7	10-1	12-1
	Spruce-pine-fir SS	9-0	11-10	15-1	18-4	9-0	11-10	15-1	17-9
	Spruce-pine-fir #1	8-9	11-6	14-1	16-3	8-3	10-6	12-10	14-10
	Spruce-pine-fir #2	8-9	11-6	14-1	16-3	8-3	10-6	12-10	14-10
	Spruce-pine-fir #3	6-10	8-8	10-7	12-4	6-3	7-11	9-8	11-3
24	Douglas fir-larch SS	9-0	11-11	15-2	18-5	9-0	11-11	14-9	17-1
	Douglas fir-larch #1	8-8	11-0	13-5	15-7	7-11	10-0	12-3	14-3
	Douglas fir-larch #2	8-1	10-3	12-7	14-7	7-5	9-5	11-6	13-4
	Douglas fir-larch #3	6-2	7-9	9-6	11-0	5-7	7-1	8-8	10-1
	Hem-fir SS	8-6	11-3	14-4	17-5	8-6	11-3	14-4	16-10 ^a
	Hem-fir #1	8-4	10-9	13-1	15-2	7-9	9-9	11-11	13-10
	Hem-fir #2	7-11	10-2	12-5	14-4	7-4	9-3	11-4	13-1
	Hem-fir #3	6-2	7-9	9-6	11-0	5-7	7-1	8-8	10-1
	Southern pine SS	8-10	11-8	14-11	18-1	8-10	11-8	14-11	18-1
	Southern pine #1	8-8	11-5	14-7	17-5	8-8	11-3	13-4	15-11
	Southern pine #2	8-6	11-0	13-1	15-5	7-9	10-0	12-0	14-0
	Southern pine #3	6-7	8-5	9-11	11-10	6-0	7-8	9-1	10-9
	Spruce-pine-fir SS	8-4	11-0	14-0	17-0	8-4	11-0	13-8	15-11
	Spruce-pine-fir #1	8-1	10-3	12-7	14-7	7-5	9-5	11-6	13-4
	Spruce-pine-fir #2	8-1	10-3	12-7	14-7	7-5	9-5	11-6	13-4
	Spruce-pine-fir #3	6-2	7-9	9-6	11-0	5-7	7-1	8-8	10-1

NOTE: Check sources for availability of lumber in lengths greater than 20 feet.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kN/m². a. End bearing length shall be increased to 2 inches.

780 CMR TABLE 5502.3.3(1)
CANTILEVER SPANS FOR FLOOR JOISTS SUPPORTING LIGHT-FRAME
EXTERIOR BEARING WALL AND ROOF ONLY^{a,b,c,f,g,h}
(Floor Live Load ≤ 40 psf, Roof Live Load ≤ 20 psf)

Member & Spacing	Maximum Cantilever Span (Uplift Force at Backspan Support in Lbs.) ^{d,e}											
	Ground Snow Load											
	≤20 psf			30 psf			50 psf			70 psf		
	Roof Width			Roof Width			Roof Width			Roof Width		
	24 ft.	32 ft.	40 ft.	24 ft.	32 ft.	40 ft.	24 ft.	32 ft.	40 ft.	24 ft.	32 ft.	40 ft.
2 x 8 @ 12"	20" (177)	15" (227)	—	18" (209)	—	—	—	—	—	—	—	—
2 x 10 @ 16"	29" (228)	21" (297)	16" (364)	26" (271)	18" (354)	—	20" (375)	—	—	—	—	—
2 x 10 @ 12"	36" (166)	26" (219)	20" (270)	34" (198)	22" (263)	16" (324)	26" (277)	—	—	19" (356)	—	—
2 x 12 @ 16"	—	32" (287)	25" (356)	36" (263)	29" (345)	21" (428)	29" (367)	20" (484)	—	23" (471)	—	—
2 x 12 @ 12"	—	42" (209)	31" (263)	—	37" (253)	27" (317)	36" (271)	27" (358)	17" (447)	31" (348)	19" (462)	—
2 x 12 @ 8"	—	48" (136)	45" (169)	—	48" (164)	38" (206)	—	40" (233)	26" (294)	36" (230)	29" (304)	18" (379)

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 0.0479kN/m².

- Tabulated values are for clear-span roof supported solely by exterior bearing walls.
- Spans are based on No. 2 Grade lumber of Douglas fir-larch, hem-fir, southern pine, and spruce-pine-fir for repetitive (three or more) members.
- Ratio of backspan to cantilever span shall be at least 3:1.
- Connections capable of resisting the indicated uplift force shall be provided at the backspan support.
- Uplift force is for a backspan to cantilever span ratio of 3:1. Tabulated uplift values are permitted to be reduced by multiplying by a factor equal to three divided by the actual backspan ratio provided (3/backspan ratio).
- Reserved.*
- A full-depth rim joist shall be provided at the cantilevered end of the joists. Solid blocking shall be provided at the cantilever support.
- Linear interpolation shall be permitted for building widths and ground snow loads other than shown.

780 CMR TABLE 5502.3.3(2)
CANTILEVER SPANS FOR FLOOR JOISTS SUPPORTING EXTERIOR BALCONY^{a,b,c,f}

Member Size	Spacing	Maximum Cantilever Span (Uplift Force at Backspan Support in Lbs.) ^{c,d}		
		Ground Snow Load		
		≤30 psf	50 psf	70 psf
2 x 8	12"	42" (139)	39" (156)	34" (165)
2 x 8	16"	36" (151)	34" (171)	29" (180)
2 x 10	12"	61" (164)	57" (189)	49" (201)
2 x 10	16"	53" (180)	49" (208)	42" (220)
2 x 10	24"	43" (212)	40" (241)	34" (255)
2 x 12	16"	72" (228)	67" (260)	57" (268)
2 x 12	24"	58" (279)	54" (319)	47" (330)

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 0.0479kN/m².

- Spans are based on No. 2 Grade lumber of Douglas fir-larch, hem-fir, southern pine, and spruce-pine-fir for repetitive (3 or more) members.
- Ratio of backspan to cantilever span shall be at least 2:1.
- Connections capable of resisting the indicated uplift force shall be provided at the backspan support.
- Uplift force is for a backspan to cantilever span ratio of 2:1. Tabulated uplift values are permitted to be reduced by multiplying by a factor equal to two divided by the actual backspan ratio provided (2/backspan ratio).
- A full-depth rim joist shall be provided at the cantilevered end of the joists. Solid blocking shall be provided at the cantilevered support.
- Linear interpolation shall be permitted for ground snow loads other than shown.

780 CMR: STATE BOARD OF BUILDING REGULATIONS AND STANDARDS
THE MASSACHUSETTS STATE BUILDING CODE

780 CMR TABLE 5502.5(1)
GIRDER SPANS^a AND HEADER SPANS^a FOR EXTERIOR BEARING WALLS
(Maximum spans for Douglas fir-larch, hem-fir, southern pine and spruce-pine-fir^b
and required number of jack studs)

GIRDERS AND HEADERS SUPPORTING	SIZE	GROUND SNOW LOAD (psf) ^a											
		30						50					
		Building width ^c (feet)											
		20		28		36		20		28		36	
	Span	NJ ^d	Span	NJ ^d	Span	NJ ^d	Span	NJ ^d	Span	NJ ^d	Span	NJ ^d	
Roof and ceiling	2-2 x 4	3-6	1	3-2	1	2-10	1	3-2	1	2-9	1	2-6	1
	2-2 x 6	5-5	1	4-8	1	4-2	1	4-8	1	4-0	1	3-8	2
	2-2 x 8	6-10	1	5-11	2	5-4	2	5-11	2	5-2	2	4-7	2
	2-2 x 10	8-5	2	7-3	2	6-6	2	7-3	2	6-3	2	5-7	2
	2-2 x 12	9-9	2	8-5	2	7-6	2	8-5	2	7-3	2	6-6	2
	3-2 x 8	8-4	1	7-5	1	6-8	1	7-5	1	6-5	2	5-9	2
	3-2 x 10	10-6	1	9-1	2	8-2	2	9-1	2	7-10	2	7-0	2
	3-2 x 12	12-2	2	10-7	2	9-5	2	10-7	2	9-2	2	8-2	2
	4-2 x 8	7-0	1	6-1	2	5-5	2	6-1	2	5-3	2	4-8	2
	4-2 x 10	11-8	1	10-6	1	9-5	2	10-6	1	9-1	2	8-2	2
Roof, ceiling and one center-bearing floor	4-2 x 12	14-1	1	12-2	2	10-11	2	12-2	2	10-7	2	9-5	2
	2-2 x 4	3-1	1	2-9	1	2-5	1	2-9	1	2-5	1	2-2	1
	2-2 x 6	4-6	1	4-0	1	3-7	2	4-0	1	3-7	2	3-3	2
	2-2 x 8	5-9	2	5-0	2	4-6	2	5-2	2	4-6	2	4-0	2
	2-2 x 10	7-0	2	6-2	2	5-6	2	6-4	2	5-6	2	5-0	2
	2-2 x 12	8-1	2	7-1	2	6-5	2	7-4	2	6-5	2	5-9	3
	3-2 x 8	7-2	1	6-3	2	5-8	2	6-5	2	5-8	2	5-1	2
	3-2 x 10	8-9	2	7-8	2	6-11	2	7-11	2	6-11	2	6-3	2
	3-2 x 12	10-2	2	8-11	2	8-1	2	9-2	2	8-1	2	7-3	2
	4-2 x 8	5-10	2	5-2	2	4-8	2	5-3	2	4-7	2	4-2	2
Roof, ceiling and one clear span floor	4-2 x 10	10-1	1	8-10	2	8-1	2	9-1	2	8-1	2	7-2	2
	4-2 x 12	11-9	2	10-3	2	9-3	2	10-7	2	9-3	2	8-4	2
	2-2 x 4	2-8	1	2-4	1	2-1	1	2-7	1	2-3	1	2-1	1
	2-2 x 6	3-11	1	3-5	2	3-1	2	3-10	2	3-4	2	3-1	2
	2-2 x 8	5-0	2	4-4	2	3-10	2	4-10	2	4-2	2	3-9	2
	2-2 x 10	6-1	2	5-3	2	4-8	2	5-11	2	5-1	2	4-7	3
	2-2 x 12	7-1	2	6-1	3	5-5	3	6-10	2	5-11	3	5-4	3
	3-2 x 8	6-3	2	5-5	2	4-10	2	6-1	2	5-3	2	4-8	2
	3-2 x 10	7-7	2	6-7	2	5-11	2	7-5	2	6-5	2	5-9	2
	3-2 x 12	8-10	2	7-8	2	6-10	2	8-7	2	7-5	2	6-8	2
Roof, ceiling and two center-bearing floors	4-2 x 8	5-1	2	4-5	2	3-11	2	4-11	2	4-3	2	3-10	2
	4-2 x 10	8-9	2	7-7	2	6-10	2	8-7	2	7-5	2	6-7	2
	4-2 x 12	10-2	2	8-10	2	7-11	2	9-11	2	8-7	2	7-8	2
	2-2 x 4	2-7	1	2-3	1	2-1	1	2-6	1	2-2	1	1-11	1
	2-2 x 6	3-9	2	3-3	2	2-11	2	3-8	2	3-2	2	2-10	2
	2-2 x 8	4-9	2	4-2	2	3-9	2	4-7	2	4-0	2	3-8	2
	2-2 x 10	5-9	2	5-1	2	4-7	3	5-8	2	4-11	2	4-5	3
	2-2 x 12	6-8	2	5-10	3	5-3	3	6-6	2	5-9	3	5-2	3
	3-2 x 8	5-11	2	5-2	2	4-8	2	5-9	2	5-1	2	4-7	2
	3-2 x 10	7-3	2	6-4	2	5-8	2	7-1	2	6-2	2	5-7	2
Roof, ceiling and two clear span floor	3-2 x 12	8-5	2	7-4	2	6-7	2	8-2	2	7-2	2	6-5	3
	4-2 x 8	4-10	2	4-3	2	3-10	2	4-9	2	4-2	2	3-9	2
	4-2 x 10	8-4	2	7-4	2	6-7	2	8-2	2	7-2	2	6-5	2
	4-2 x 12	9-8	2	8-6	2	7-8	2	9-5	2	8-3	2	7-5	2
	2-2 x 4	2-7	1	1-8	1	1-6	2	2-0	1	1-8	1	1-5	2
	2-2 x 6	3-1	2	2-8	2	2-4	2	3-0	2	2-7	2	2-3	2
	2-2 x 8	3-10	2	3-4	3	3-0	3	3-10	2	3-4	2	2-11	3
	2-2 x 10	4-9	2	4-1	3	3-8	3	4-8	2	4-0	3	3-7	3
	2-2 x 12	5-6	3	4-9	3	4-3	3	5-5	3	4-8	3	4-2	3
	3-2 x 8	4-10	2	4-2	2	3-9	2	4-9	2	4-1	2	3-8	2

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 0.0479kN/m².

- Spans are given in feet and inches.
- Tabulated values assume #2 grade lumber.
- Building width is measured perpendicular to the ridge. For widths between those shown, spans are permitted to be interpolated.
- NJ - Number of jack studs required to support each end. Where the number of required jack studs equals one, the header is permitted to be supported by an approved framing anchor attached to the full-height wall stud and to the header.
- Use 30 psf ground snow load for cases in which ground snow load is less than 30 psf and the roof live load is equal to or less than 20 psf.

780 CMR TABLE 5502.5(2)

GIRDER SPANS* AND HEADER SPANS* FOR INTERIOR BEARING WALLS
 (Maximum spans for Douglas fir-larch, hem-fir, southern pine and spruce-pine-fir^b
 and required number of jack studs)

HEADERS AND GIRDERS SUPPORTING	SIZE	BUILDING WIDTH ^c (feet)					
		20		28		36	
		Span	NJ ^d	Span	NJ ^d	Span	NJ ^d
One floor only	2-2 x 4	3- 1	1	2- 8	1	2- 5	1
	2-2 x 6	4- 6	1	3- 11	1	3- 6	1
	2-2 x 8	5- 9	1	5- 0	2	4- 5	2
	2-2 x 10	7- 0	2	6- 1	2	5- 5	2
	2-2 x 12	8- 1	2	7- 0	2	6- 3	2
	3-2 x 8	7- 2	1	6- 3	1	5- 7	2
	3-2 x 10	8- 9	1	7- 7	2	6- 9	2
	3-2 x 12	10- 2	2	8- 10	2	7- 10	2
	4-2 x 8	9- 1	1	7- 8	1	6- 9	1
	4-2 x 10	10- 1	1	8- 9	1	7- 10	2
	4-2 x 12	11- 9	1	10- 2	2	9- 1	2
Two floors	2-2 x 4	2- 2	1	1- 10	1	1- 7	1
	2-2 x 6	3- 2	2	2- 9	2	2- 5	2
	2-2 x 8	4- 0	2	3- 6	2	3- 2	2
	2-2 x 10	4- 11	2	4- 3	2	3- 10	3
	2-2 x 12	5- 9	2	5- 0	3	4- 5	3
	3-2 x 8	5- 1	2	4- 5	2	3- 11	2
	3-2 x 10	6- 2	2	5- 4	2	4- 10	2
	3-2 x 12	7- 2	2	6- 3	2	5- 7	3
	4-2 x 8	6- 1	1	5- 3	2	4- 8	2
	4-2 x 10	7- 2	2	6- 2	2	5- 6	2
	4-2 x 12	8- 4	2	7- 2	2	6- 5	2

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

- Spans are given in feet and inches.
- Tabulated values assume #2 grade lumber.
- Building width is measured perpendicular to the ridge. For widths between those shown, spans are permitted to be interpolated.
- NJ - Number of jack studs required to support each end. Where the number of required jack studs equals one, the header is permitted to be supported by an approved framing anchor attached to the full-height wall stud and to the header.

5502.6 Bearing. The ends of each joist, beam or girder shall have not less than 1.5 inches (38 mm) of bearing on wood or metal and not less than three inches (76 mm) on masonry or concrete except where supported on a one-inch-by-four-inch (25.4 mm by 102 mm) ribbon strip and nailed to the adjacent stud or by the use of approved joist hangers.

5502.6.1 Floor Systems. Joists framing from opposite sides over a bearing support shall lap a minimum of three inches (76 mm) and shall be nailed together with a minimum three 10d face nails. A wood or metal splice with strength equal to or greater than that provided by the nailed lap is permitted.

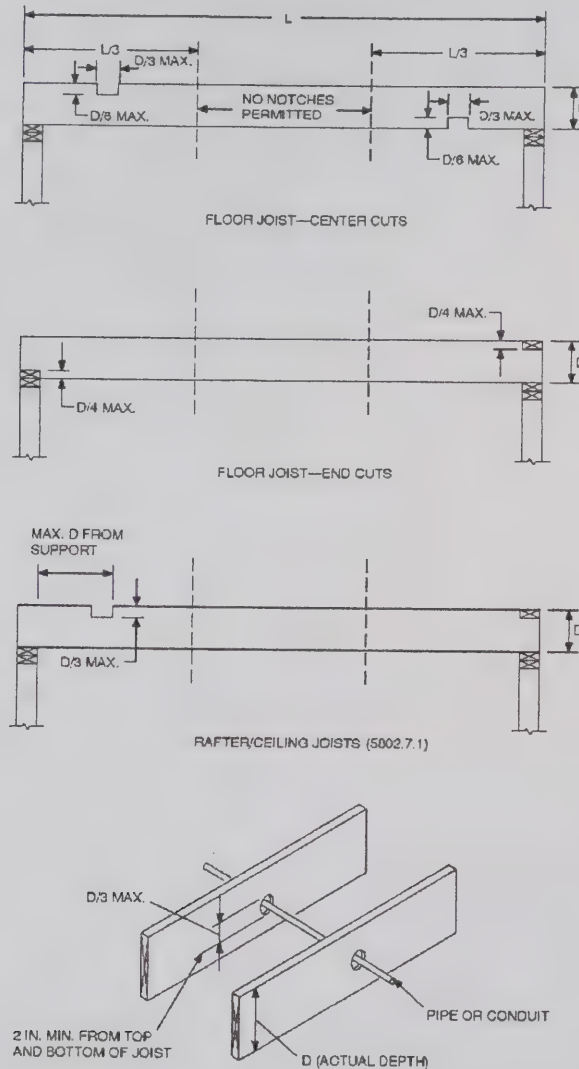
5502.6.2 Joist Framing. Joists framing into the side of a wood girder shall be supported by approved framing anchors or on ledger strips not less than nominal two inches by two inches (51 mm by 51 mm).

5502.7 Lateral restraint at supports. Joists shall be supported laterally at the ends and intermediate supports by full-depth solid blocking not less than two inches (51 mm) nominal in thickness; or by attachment to a header, band or rim joist, or to an adjoining stud; or shall be otherwise provided with lateral support to prevent rotation.

5502.7.1 Bridging. Joists exceeding a nominal 2 inches by 12 inches (51 mm by 305 mm) shall be supported laterally by solid blocking, diagonal bridging (wood or metal), or a continuous one-inch-by-three-inch (25.4 mm by 76 mm) strip nailed across the bottom of joists perpendicular to joists at intervals not exceeding eight feet (2438 mm).

5502.8 Drilling and Notching. Structural floor members shall not be cut, bored or notched in excess of the limitations specified in 780CMR 5502. See 780 CMR Figure 5502.8.

780 CMR FIGURE 5502.8
CUTTING, NOTCHING AND DRILLING



For SI: 1 inch = 25.4 mm.

5502.8.1 Sawn Lumber. Notches in solid lumber joists, rafters and beams shall not exceed one-sixth of the depth of the member, shall not be longer than one-third of the depth of the member and shall not be located in the middle one-third of the span. Notches at the ends of the member shall not exceed $\frac{1}{4}$ the depth of the member. The tension side of members four inches (102 mm) or greater in nominal thickness shall not be notched except at the ends of the members. The diameter of holes bored or cut into members shall not exceed $\frac{1}{3}$ the depth of the member. Holes shall not be closer than two inches (51 mm) to the top or bottom of the member, or to any other hole located in the member. Where the member is also notched, the hole shall not be closer than two inches (51 mm) to the notch.

5502.8.2 Engineered Wood Products. Cuts, notches and holes bored in trusses, laminated veneer lumber, glue-laminated members or I-joists are not permitted unless the effects of such penetrations are specifically considered in the design of the member.

5502.9 Fastening. Floor framing shall be nailed in accordance with 780 CMR Table 5602.3(1). Where posts and beam or girder construction is used to support floor framing, positive connections shall be provided to ensure against uplift and lateral displacement.

5502.10 Framing of Openings. Openings in floor framing shall be framed with a header and trimmer joists. When the header joist span does not exceed four feet (1219 mm), the header joist may be a single member the same size as the floor joist. Single trimmer joists may be used to carry a single header joist that is located within three feet (914 mm) of the trimmer joist bearing. When the header joist span exceeds four feet (1219 mm), the trimmer joists and the header joist shall be doubled and of sufficient cross section to support the floor joists framing into the header. Approved hangers shall be used for the header joist to trimmer joist connections when the header joist span exceeds six feet (1829 mm). Tail joists over 12 feet (3658 mm) long shall be supported at the header by framing anchors or on ledger strips not less than two inches by two inches (51 mm by 51 mm).

5502.11 Wood Trusses.

5502.11.1 Design. *Wood trusses shall be designed in accordance with approved engineering practice. The design and manufacture of metal-plate-connected wood trusses shall comply with ANSI/TPI 1. The truss design drawings shall be prepared by a Massachusetts-registered architect or registered professional engineer.*

5502.11.2 Bracing. Trusses shall be braced to prevent rotation and provide lateral stability in

accordance with the requirements specified in the construction documents for the building and on the individual truss design drawings. In the absence of specific bracing requirements, trusses shall be braced in accordance with the Building Component Safety Information (BCSI 1-03) *Guide to Good Practice for Handling, Installing & Bracing of Metal Plate Connected Wood Trusses*.

5502.11.3 Alterations to Trusses. Truss members and components shall not be cut, notched, spliced or otherwise altered in any way without the approval of a registered design professional. Alterations resulting in the addition of load (e.g., HVAC equipment, water heater, etc.), that exceed the design load for the truss, shall not be permitted without verification that the truss is capable of supporting the additional loading.

5502.11.4 Truss Design Drawings. Truss design drawings, prepared in compliance with 780 CMR 5502.11.1, shall be provided to the building official and approved prior to installation. Truss design drawing shall be provided with the shipment of trusses delivered to the job site. Truss design drawings shall include, at a minimum, the information specified in 780 CMR 5502.11.4.1 through .12:

1. Slope or depth, span, and spacing.
2. Location of all joints.
3. Required bearing widths.
4. Design loads as applicable.
 - 4.1. Top chord live load (including snow loads).
 - 4.2. Top chord dead load.
 - 4.3. Bottom chord live load.
 - 4.4. Bottom chord dead load.
 - 4.5. Concentrated loads and their points of application.
 - 4.6. *Controlling wind loads.*
5. Adjustments to lumber and joint connector design values for conditions of use.
6. Each reaction force and direction.
7. Joint connector type and description (e.g., size, thickness or gauge); and the dimensioned location of each joint connector except where symmetrically located relative to the joint interface.
8. Lumber size, species and grade for each member.
9. Connection requirements for:
 - 9.1. Truss-to-truss girder.
 - 9.2. Truss ply-to-ply.
 - 9.3. Field splices.
10. *Calculated deflection ratio and/or maximum deflection for live and total load.*
11. Maximum axial compression forces in the truss members to enable the building designer to design the size, connections and anchorage of the permanent continuous lateral bracing. Forces shall be shown on the truss drawing or

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on supplemental documents.

12. Required permanent truss member bracing location.

5502.12 Draftstopping Required. When there is usable space both above and below the concealed space of a floor/ceiling assembly, draftstops shall be installed so that the area of the concealed space does not exceed 1,000 square feet (92.9 m²). Draftstopping shall divide the concealed space into approximately equal areas. Where the assembly is enclosed by a floor membrane above and a ceiling membrane below draftstopping shall be provided in floor/ceiling assemblies under the following circumstances:

1. Ceiling is suspended under the floor framing.
2. Floor framing is constructed of truss-type open-web or perforated members.

5502.12.1 Materials. Draftstopping materials shall not be less than ½-inch (12.7 mm) gypsum board, ¾-inch (9.5 mm) wood structural panels, ¾-inch (9.5 mm) Type 2-M-W particleboard or other approved materials adequately supported. Draftstopping shall be installed parallel to the floor framing members unless otherwise approved by the building official. The integrity of all draftstops shall be maintained.

5502.13 Fireblocking Required. Fireblocking shall be provided in wood-frame floor construction and floor-ceiling assemblies in accordance with 780 CMR 5602.8.

780 CMR 5503 FLOOR SHEATHING

5503.1 Lumber Sheathing. Maximum allowable spans for lumber used as floor sheathing shall conform to 780 CMR Tables 5503.1, 5503.2.1.1(1) and 5503.2.1.1(2).

**780 CMR TABLE 5503.1
MINIMUM THICKNESS OF LUMBER
FLOOR SHEATHING**

JOIST OR BEAM SPACING (inches)	MINIMUM NET THICKNESS	
	Perpendicular to joist	Diagonal to joist
24	1 1/16	¾
16	¾	¾
48 ^a	1 ½ T & G	N/A
54 ^b		
60 ^c		

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 6.895 kPa.

- a. For this support spacing, lumber sheathing shall have a minimum F_b of 675 and minimum E of 1,100,000 (see AF&PA/NDS).
- b. For this support spacing, lumber sheathing shall have a minimum F_b of 765 and minimum E of 1,400,000 (see AF&PA/NDS).
- c. For this support spacing, lumber sheathing shall have a minimum F_b of 855 and minimum E of 1,700,000

(see AF&PA/NDS).

5503.1.1 End Joints. End joints in lumber used as subflooring shall occur over supports unless end-matched lumber is used, in which case each piece shall bear on at least two joists. Subflooring may be omitted when joist spacing does not exceed 16 inches (406 mm) and a 1-inch (25.4 mm) nominal tongue-and-groove wood strip flooring is applied perpendicular to the joists.

5503.2 Wood Structural Panel Sheathing.

5503.2.1 Identification and Grade. Wood structural panel sheathing used for structural purposes shall conform to DOC PS 1, DOC PS 2 or, when manufactured in Canada, CSA 0437 or CSA 0325. All panels shall be identified by a grade mark of certificate of inspection issued by an approved agency.

5503.2.1.1 Subfloor and Combined Subfloor Underlayment. Where used as subflooring or combination subfloor underlayment, wood structural panels shall be of one of the grades specified in 780 CMR Table 5503.2.1.1(1). When sanded plywood is used as combination subfloor underlayment, the grade shall be as specified in Table 5503.2.1.1(2).

5503.2.2 Allowable Spans. The maximum allowable span for wood structural panels used as subfloor or combination subfloor underlayment shall be as set forth in 780 CMR Table 5503.2.1.1(1). The maximum span for sanded plywood combination subfloor underlayment shall be as set forth in 780 CMR Table 5503.2.1.1(2).

5503.2.3 Installation. Wood structural panels used as subfloor or combination subfloor underlayment shall be attached to wood framing in accordance with 780 CMR Table 5602.3(1) and shall be attached to cold-formed steel framing in accordance with 780 CMR Table 5505.3.1(2).

5503.3 Particleboard.

5503.3.1 Identification and Grade. Particleboard shall conform to ANSI A208.1 and shall be so identified by a grade mark or certificate of inspection issued by an approved agency.

5503.3.2 Floor Underlayment. Particleboard floor underlayment shall conform to Type PBU and shall not be less than ¼ inch (6.4 mm) in thickness.

5503.3.3 Installation. Particleboard underlayment shall be installed in accordance with the recommendations of the manufacturer and attached to framing in accordance with 780 CMR Table 5602.3(1).

780 CMR 5503.2.1.1(1)

ALLOWABLE SPANS AND LOADS FOR WOOD STRUCTURAL PANELS FOR ROOF
AND SUBFLOOR SHEATHING AND COMBINATION SUBFLOOR UNDERLAYMENT^{a,b,c}

SPAN RATING	MINIMUM NOMINAL PANEL THICKNESS (inch)	MAXIMUM SPAN (inches)		LOAD (pounds per square foot, at maximum span)		MAXIMUM SPAN (inches)
		With edge support ^d	Without edge support	Total load	Live load	
Sheathing ^e		Roof ^f				Subfloor ^j
12/0	⁵ / ₁₆	12	12	40	30	0
16/0	⁵ / ₁₆	16	16	40	30	0
20/0	⁵ / ₁₆	20	20	40	30	0
24/0	³ / ₈	24	20 ^g	40	30	0
24/16	⁷ / ₁₆	24	24	50	40	16
32/16	¹⁵ / ₃₂ , ¹ / ₂	32	28	40	30	16 ^h
40/20	¹⁹ / ₃₂ , ⁵ / ₈	40	32	40	30	20 ^{h,i}
48/2	²³ / ₃₂ , ³ / ₈	48	36	45	35	24
60/32	⁷ / ₈	60	48	45	35	32
Underlayment, C-C plugged, single floor ^e		Roof ^f				Combination subfloor underlayment ^k
16 o.c.	¹⁹ / ₃₂ , ³ / ₈	24	24	50	40	16 ⁱ
20 o.c.	¹⁹ / ₃₂ , ⁵ / ₈	32	32	40	30	20 ^{i,j}
24 o.c.	²³ / ₃₂ , ³ / ₄	48	36	35	25	24
32 o.c.	⁷ / ₈	48	40	50	40	32
48 o.c.	¹³ / ₃₂ , 1 ¹ / ₈	60	48	50	40	48

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 0.0479kN/m².

- The allowable total loads were determined using a dead load of 10 psf. If the dead load exceeds 10 psf, then the live load shall be reduced accordingly.
- Panels continuous over two or more spans with long dimension perpendicular to supports. Spans shall be limited to values shown because of possible effect of concentrated loads.
- Applies to panels 24 inches or wider.
- Lumber blocking, panel edge clips (one midway between each support, except two equally spaced between supports when span is 48 inches), tongue-and-groove panel edges, or other approved type of edge support.
- Includes Structural I panels in these grades.
- Uniform load deflection limitation: $\frac{1}{180}$ of span under live load plus dead load, $\frac{1}{240}$ of span under live load only.
- Maximum span 24 inches for $\frac{15}{32}$ - and $\frac{1}{2}$ -inch panels.
- Maximum span 24 inches where $\frac{3}{4}$ -inch wood finish flooring is installed at right angles to joists.
- Maximum span 24 inches where 1.5 inches of lightweight concrete or approved cellular concrete is placed over the subfloor.
- Unsupported edges shall have tongue-and-groove joints or shall be supported with blocking unless minimum nominal $\frac{1}{4}$ -inch thick underlayment with end and edge joints offset at least two inches or 1.5 inches of lightweight concrete or approved cellular concrete is placed over the subfloor, or $\frac{3}{4}$ -inch wood finish flooring is installed at right angles to the supports. Allowable uniform live load at maximum span, based on deflection of $\frac{1}{360}$ of span, is 100 psf.
- Unsupported edges shall have tongue-and-groove joints or shall be supported by blocking unless nominal $\frac{1}{4}$ -inch-thick underlayment with end and edge joints off-set at least two inches or $\frac{3}{4}$ -inch wood finish flooring is installed at right angles to the supports. Allowable uniform live load at maximum span, based on deflection of $\frac{1}{360}$ of span, is 100 psf, except panels with a span rating of 48 on center are limited to 65 psf total uniform load at maximum span.

780 CMR TABLE 5503.2.1.1(2)

ALLOWABLE SPANS FOR SANDED PLYWOOD
COMBINATION SUBFLOOR UNDERLAYMENT^a

IDENTIFICATION	SPACING OF JOISTS (inches)		
	16	20	24
Species group ^b	—	—	—
1	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$
2, 3	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{7}{8}$
4	$\frac{3}{4}$	$\frac{7}{8}$	1

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 0.0479kN/m².

- Plywood continuous over two or more spans and face grain perpendicular to supports. Unsupported edges shall be tongue-and-groove or blocked except where nominal $\frac{1}{4}$ -inch-thick underlayment or $\frac{3}{4}$ -inch wood finish floor is used. Allowable uniform live load at maximum span based on deflection of $\frac{1}{360}$ of span is 100 psf.
- Applicable to all grades of sanded exterior-type plywood.

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780 CMR 780 CMR 5504**PRESSURE PRESERVATIVELY****TREATED-WOOD FLOORS (ON GROUND)**

5504.1 General. Pressure preservatively treated-wood basement floors and floors on ground shall be designed to withstand axial forces and bending moments resulting from lateral soil pressures at the base of the exterior walls and floor live and dead loads. Floor framing shall be designed to meet joist deflection requirements in accordance with 780 CMR 5301.

5504.1.1 Unbalanced Soil Loads. Unless special provision is made to resist sliding caused by unbalanced lateral soil loads, wood basement floors shall be limited to applications where the differential depth of fill on opposite exterior foundation walls is two feet (610 mm) or less.

5504.1.2 Construction. Joists in wood basement floors shall bear tightly against the narrow face of studs in the foundation wall or directly against a band joist that bears on the studs. Plywood subfloor shall be continuous over lapped joists or over butt joints between in-line joists. Sufficient blocking shall be provided between joists to transfer lateral forces at the base of the end walls into the floor system.

5504.1.3 Uplift and Buckling. Where required, resistance to uplift or restraint against buckling shall be provided by interior bearing walls or properly designed stub walls anchored in the supporting soil below.

5504.2 Site Preparation. The area within the foundation walls shall have all vegetation, topsoil and foreign material removed, and any fill material that is added shall be free of vegetation and foreign material. The fill shall be compacted to assure uniform support of the pressure preservatively treated-wood floor sleepers.

5504.2.1 Base. A minimum four-inch-thick (102 mm) granular base of gravel having a maximum size of $\frac{3}{4}$ inch (19.1 mm) or crushed stone having a maximum size of $\frac{1}{2}$ inch (12.7 mm) shall be placed over the compacted earth.

5504.2.2 Moisture Barrier. Polyethylene sheeting of minimum six-mil (0.15 mm) thickness shall be placed over the granular base. Joints shall be lapped six inches (152 mm) and left unsealed. The polyethylene membrane shall be placed over the pressure preservatively treated-wood sleepers and shall not extend beneath the footing plates of the exterior walls.

5504.3 Materials. All framing materials, including sleepers, joists, blocking and plywood subflooring, shall be pressure preservatively treated and dried after treatment in accordance with AWPAC22.

780 CMR 5505 STEEL FLOOR FRAMING

5505.1 Cold-formed Steel Floor Framing. Elements shall be straight and free of any defects that would significantly affect structural performance. Cold-formed steel floor framing members shall comply with the requirements of 780 CMR 5505.

5505.1.1 Applicability Limits. The provisions of 780 CMR 5505 shall control the construction of steel floor framing for buildings not greater than 60 feet (18,288 mm) in length perpendicular to the joist span, not greater than 36 feet (10973 mm) in width parallel to the joist span, and not greater than two stories in height with each story not greater than ten feet (3048 mm) high. Steel floor framing constructed in accordance with the provisions of 780 CMR 5505 shall be limited to sites subjected to a maximum design wind speed of 110 miles per hour Exposure A, B or C and a maximum ground snow load of 70 pounds per square foot (3.35 kN/m²).

5505.1.2 In-line Framing. When supported by steel-framed walls in accordance with 780 CMR 5603, steel floor framing shall be constructed with floor joists located directly in-line with load-bearing studs located below the joists with a maximum tolerance of $\frac{3}{4}$ inch (19.1 mm) between the center lines of the joist and the stud.

5505.2 Structural Framing. Load-bearing floor framing members shall comply with 780 CMR Figure 5505.2(1) and with the dimensional and minimum thickness requirements specified in 780 CMR Tables 5505.2(1) and 5505.2(2). Tracks shall comply with 780 CMR Figure 5505.2(2) and shall have a minimum flange width of 1 $\frac{1}{4}$ inches (32 mm). The maximum inside bend radius for members shall be the greater of $\frac{3}{32}$ inch (2.4 mm) or twice the uncoated steel thickness. Holes in joist webs shall conform to 780 CMR Figure 5505.2(3) and to the dimensional requirements specified in 780 CMR Table 5505.2(3). Holes shall be permitted only along the centerline of the web of the framing member. Holes for 800S162-33, 1000S162-43, 1200S162-43 and 1200S162-54 nominal joist sizes located less than ten inches (254 mm) from the edge of load-bearing surface shall be patched in accordance with 780 CMR 5505.3.6.

780 CMR TABLE 5505.2(1)
COLD-FORMED STEEL JOIST SIZES

MEMBER DESIGNATION ^a	WEB DEPTH (inches)	MINIMUM FLANGE WIDTH (inches)	MAXIMUM FLANGE WIDTH (inches)	MINIMUM LIP SIZE (inches)
550S162-t	5.5	1.625	2	0.5
800S162-t	8	1.625	2	0.5
1000S162-t	10	1.625	2	0.5
1200S162-t	12	1.625	2	0.5

For SI: 1 inch = 25.4 mm.

- a. The member designation is defined by the first number representing the member depth in $\frac{1}{100}$ inches, the letter "S" representing a stud or joist member, the second number representing the flange width in $\frac{1}{100}$ inches, and the letter "t" shall be a number representing the minimum base metal thickness in mils [See 780 CMR Table 5505.2(2)].

780 CMR TABLE 5505.2(2)
MINIMUM THICKNESS OF COLD-FORMED STEEL MEMBERS

DESIGNATION (mils)	MINIMUM UNCOATED THICKNESS (inches)	REFERENCE GAGE NUMBER
33	0.033	20
43	0.043	18
54	0.054	16
68	0.068	14

For SI: 1 inch = 25.4 mm, 1 mil = 0.0254 mm.

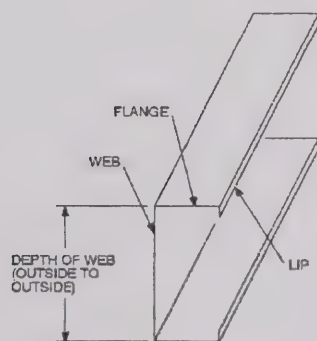
780 CMR TABLE 5505.2(3)
MAXIMUM HOLE DIMENSIONS AND SPACING IN JOIST WEBS

NOMINAL MEMBER SIZE	MAXIMUM HOLE DEPTH ^a (inches)	MAXIMUM HOLE LENGTH ^b (inches)	MINIMUM HOLE SPACING (inches)	MINIMUM HOLE EDGE DISTANCE ^c (inches)
550S162-33	2	5.25	16.5	10
550S162-43	2	5.25	16.5	10
550S162-54	2	5.25	16.5	10
550S162-68	2	5.25	16.5	10
800S162-33	1.5	4	24	10
800S162-43	3	6	24	10
800S162-54	3	6	24	10
800S162-68	3	6	24	10
1000S162-43	1.5	4	24	10
1000S162-54	4	6	24	10
1000S162-68	4	6	24	10
1200S162-43	1.5	4	24	10
1200S162-54	1.5	4	24	10
1200S162-68	4.75	6	24	10

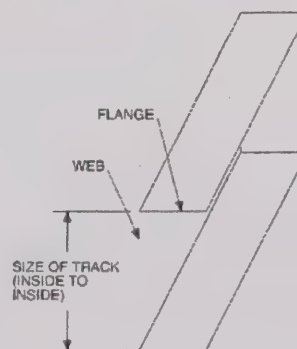
For SI: 1 inch = 25.4 mm.

- a. The dimension of the hole measured across the depth of the joist web.
b. The dimension of the hole measured along the length of the joist.
c. Edge distance is measured from the edge of the hole to the edge of bearing support.

780 CMR FIGURE 5505.2(1)
C-SECTION

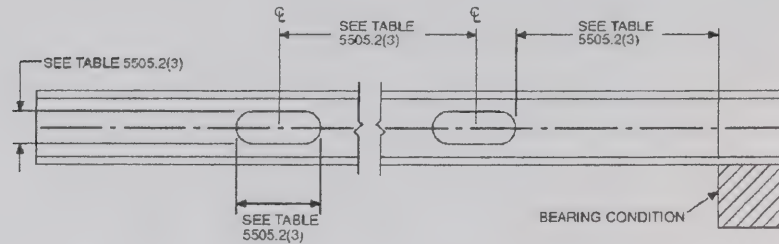


780 CMR FIGURE 5505.2(2)
TRACK SECTION



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780 CMR FIGURE 5505.2(3)
FLOOR JOIST WEB HOLES



For SI: 1 inch = 25.4 mm.

5505.2.1 Material. Load-bearing members utilized in steel floor construction shall be cold formed to shape from structural quality sheet steel complying with the requirements of one of the following:

1. ASTM A 653: Grades 33, 37, 40 and 50 (Class 1 and 3).
2. ASTM A 792: Grades 33, 37, 40 and 50A.
3. ASTM A 875: Grades 33, 37, 40 and 50 (Class 1 and 3).
4. Steels that comply with ASTM A 653, except for tensile and elongation, shall be permitted provided the ratio of tensile strength to yield point is at least 1.08 and the total elongation is at least 10% for a two-inch (51 mm) gage length or 7% for an eight-inch (203 mm) gage length.

5505.2.2 Identification. Load-bearing steel framing members shall have a legible label, stencil, stamp or embossment with the following information as a minimum:

1. Manufacturer's identification.
2. Minimum uncoated steel thickness in inches (mm).
3. Minimum coating designation.
4. Minimum yield strength, in kips per square inch (ksi) (kPa).

5505.2.3 Corrosion Protection. Load-bearing steel framing shall have a metallic coating complying with one of the following:

1. A minimum of G 60 in accordance with ASTM A 653.
2. A minimum of AZ 50 in accordance with ASTM A 792.
3. A minimum of GF 60 in accordance with ASTM A 875.

5505.2.4 Fastening Requirements. Screws for steel-to-steel connections shall be installed with a

minimum edge distance and center-to-center spacing of 0.5 inch (12.7 mm), shall be self-drilling tapping, and shall conform to SAE J78. Floor sheathing shall be attached to steel joists with minimum No. 8 self-drilling tapping screws that conform to SAE J78. Screws attaching floor-sheathing-to-steel joists shall have a minimum head diameter of 0.292 inch (7.4mm) with countersunk heads and shall be installed with a minimum edge distance of 0.375 inch (9.5 mm). Gypsum board ceilings shall be attached to steel joists with minimum No. 6 screws conforming to ASTM C 954 and shall be installed in accordance with Section R702. For all connections, screws shall extend through the steel a minimum of three exposed threads. All self-drilling tapping screws conforming to SAE J78 shall have a Type II coating in accordance with ASTM B 633.

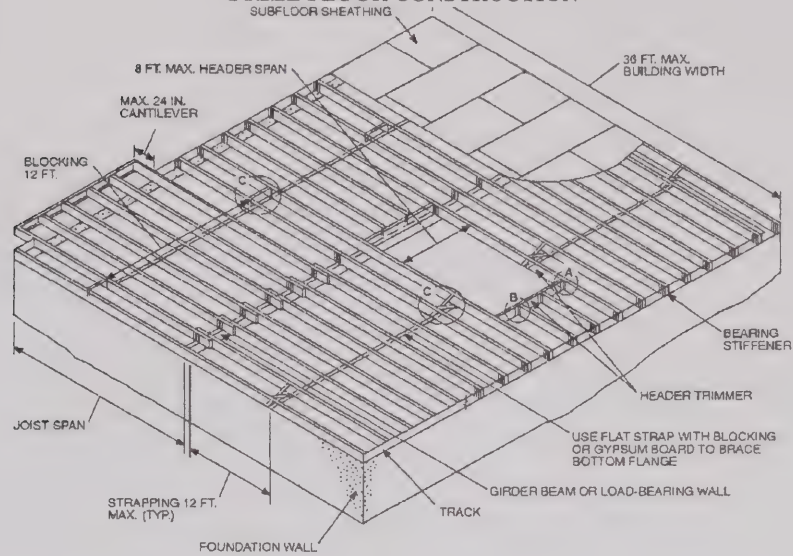
Where No. 8 screws are specified in a steel to steel connection the required number of screws in the connection is permitted to be reduced in accordance with the reduction factors in 780 CMR Table 5505.2.4 when larger screws are used or when one of the sheets of steel being connected is thicker than 33 mils (0.84mm). When applying the reduction factor the resulting number of screws shall be rounded up.

780 CMR TABLE 5505.2.4
SCREW SUBSTITUTION FACTOR

SCREW SIZE	THINNEST CONNECTED STEEL SHEET (mils)	
	33	43
# 8	1	0.67
# 10	0.93	0.62
# 12	0.86	0.56

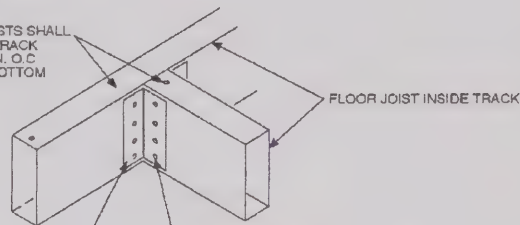
For SI: 1 mil = 0.0254 mm.

780 CMR FIGURE 5505.3 STEEL FLOOR CONSTRUCTION



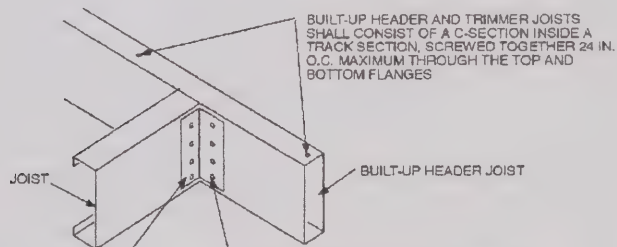
For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

BUILT-UP HEADER AND TRIMMER JOISTS SHALL CONSIST OF A C-SECTION INSIDE A TRACK SECTION, SCREWED TOGETHER 24 IN. O.C. MAXIMUM THROUGH THE TOP AND BOTTOM FLANGES



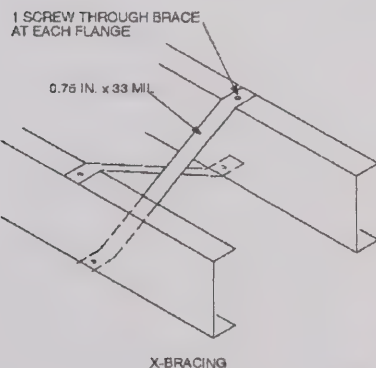
CLIP ANGLE (BOTH SIDES OF CONNECTION)
MIN. LENGTH = JOIST WEB DEPTH
MINUS $\frac{1}{2}$ IN.

BUILT-UP HEADER OR TRIMMER JOIST



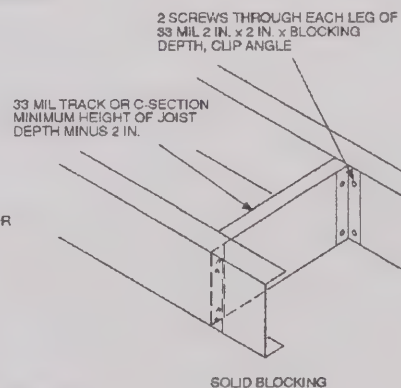
CLIP ANGLE (BOTH SIDES OF CONNECTION)
MINIMUM LENGTH = JOIST WEB DEPTH
MINUS $\frac{1}{2}$ IN.

JOIST TO HEADER JOIST



X-BRACING

OR



SOLID BLOCKING

BLOCKING OPTIONS

For SI: 1 inch = 25.4 mm, 1 mil = 0.0254 mm.

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5505.3 Floor Construction. Cold-formed steel floors shall be constructed in accordance with 780 CMR 5505.3 and 780 CMR Figure 5505.3.

5505.3.1 Floor to Foundation or Bearing Wall Connections. Cold-formed steel floors shall be anchored to foundations, wood sills or load-bearing walls in accordance with 780 CMR Table 5505.3.1(1) and 780 CMR Figure 5505.3.1(1), 5505.3.1(2), 5505.3.1(3), 5505.3.1(4), 5505.3.1(5) or 5505.3.1(6). Continuous steel joists supported by interior load-bearing walls shall be constructed in accordance with 780 CMR Figure 5505.3.1(7). Lapped steel joists shall be constructed in accordance with 780 CMR Figure 5505.3.1(8). Fastening of steel joists to other framing members shall be in accordance with 780 CMR Table 5505.3.1(2).

5505.3.2 Allowable Joist Spans. The clear span of cold-formed steel floor joists shall not exceed the limits set forth in 780 CMR Table 5505.3.2. Floor joists shall have a minimum bearing length of 1.5 inches (38 mm). When continuous joists are used the interior bearing supports shall be located within two feet (610 mm) of mid span of the steel joists, and the individual spans shall not exceed the spans in 780 CMR Table 5505.3.2. Bearing stiffeners shall be installed at each bearing location in accordance with 780 CMR 5505.3.4 and as shown in 780 CMR Figure 5505.3.

5505.3.3 Joist Bracing. The top flanges of steel joists shall be laterally braced by the application of floor sheathing fastened to the joists in accordance with 780 CMR Table 5505.3.1(2). Floor joists with spans that exceed 12 feet (3658 mm) shall have the bottom flanges laterally braced in accordance with one of the following:

1. Gypsum board installed with minimum No. 6 screws in accordance with 780 CMR 5702.
2. Continuous steel strapping installed in accordance with 780 CMR Figure 5505.3. Steel straps shall be at least 1.5 inches (38 mm) in width and 33 mils (0.84 mm) in thickness. Straps shall be fastened to the bottom flange at each joist with at least one No. 8 screw and shall be fastened to blocking with at least two No. 8 screws. Blocking or bridging (X-bracing) shall be installed between joists in-line with straps at a maximum spacing of 12 feet (3658 mm) measured perpendicular to the joist run and at the termination of all straps.

5505.3.4 Bearing Stiffeners. Bearing stiffeners shall be installed at all bearing locations for steel floor joists. A bearing stiffener shall be fabricated from a minimum 33 mil (0.84 mm) C-section or 43 mil (1.09 mm) track section. Each stiffener shall be fastened to the web of the joist with a

minimum of four No. 8 screws equally spaced as shown in Figure 5505.3.4. Stiffeners shall extend across the full depth of the web and shall be installed on either side of the web.

5505.3.5 Cutting and Notching. Flanges and lips of load-bearing steel floor framing members shall not be cut or notched.

5505.3.6 Hole Patching. Web holes for 800S162-33, 1000S162-43, 1200S162-43 and 1200S162-54 nominal joist sizes with dimensions conforming to 780 CMR 5505.2 that are closer than ten inches (305 mm) from the edge of the hole to the edge of the bearing surface shall be patched with a solid steel plate, C-section or track section in accordance with 780 CMR Figure 5505.3.6. The steel patch shall be of a minimum thickness as the receiving member and shall extend at least one inch (25.4 mm) beyond all edges of the hole. The steel patch shall be fastened to the web with No. 8 screws (minimum) spaced no greater than one inch (25.4 mm) center-to-center along the edges of the patch, with a minimum edge distance of 0.5 inch (12.7 mm).

5505.3.7 Floor Cantilevers. Floor cantilevers shall not exceed 24 inches (610 mm) as illustrated in 780 CMR Figure 5505.3. The cantilever back-span shall extend a minimum of six feet (1830 mm) within the building, and shall be fastened to a bearing condition in accordance with 780 CMR 5505.3.1. Floor cantilevers shall be permitted only on the second floor of a two-story building or the first floor of a one-story building. Floor framing that is cantilevered and supports the cantilevered floor only shall consist of single joist members in accordance with 780 CMR 5505.3.2. Floor framing that is cantilevered and supports the cantilevered floor and the roof framing load above shall consist of double joist members of the same size and material thickness as that for single joist members in accordance with 780 CMR 5505.3.2, and shall be fastened web-to-web with minimum No. 8 screws at 24 inches (610 mm) maximum on-center spacing top and bottom. Built-up floor framing consisting of a C-section inside a track section, fastened at the top and bottom flanges by minimum No. 8 screws at 24 inches (610 mm) maximum on center spacing, is permitted in lieu of the web-to-web double joist method.

5505.3.8 Splicing. Joists and other structural members shall not be spliced. Splicing of tracks shall conform with 780 CMR Figure 5505.3.8.

5505.3.9 Framing of Openings. Openings in floor framing shall be framed with header and trimmer joists. Header joist spans shall not exceed eight feet (2438 mm). Header and trimmer joists shall be fabricated from joist and track sections, which shall be of a minimum size and thickness as the adjacent floor joists and shall be installed in accordance with 780 CMR Figure

5505.3. Each header joist shall be connected to trimmer joists with a minimum of four two-inch-by-two-inch (51 mm by 51 mm) clip angles. Each clip angle shall be fastened to both

the header and trimmer joists with four No. 8 screws, evenly spaced, through each leg of the clip angle. The clip angles shall have a steel thickness not less than that of the floor joist.

780 CMR TABLE 5505.3.1(1)
FLOOR TO FOUNDATION OR BEARING WALL CONNECTION REQUIREMENTS^{a,b}

FRAMING CONDITION	WIND SPEED (mph) AND EXPOSURE	
	Up to 110 A/B or 85 C or Seismic Design Categories A, B, C	Up to 110 C
Floor joist to wall track of exterior steel load-bearing wall per Figure 5505.3.1(1)	2-No. 8 screws	3-No. 8 screws
Floor joist track to wood sill per Figure 5505.3.1(2)	Steel plate spaced at 3" o.c., with 4-No. 8 screws and 4-10d or 6-8d common nails	Steel plate, spaced at 2" o.c., with 4-No. 8 screws and 4-10d or 6-8d common nails
Floor joist track to foundation per Figure 5505.3.1(3)	½" minimum diameter anchor bolt and clip angle spaced at 6" o.c. with 8-No. 8 screws	½" minimum diameter anchor bolt and clip angle spaced at 4" o.c. with 8-No. 8 screws
Joist cantilever to wall track per Figure 5505.3.1(4)	2-No. 8 screws per stiffener or bent plate	3-No. 8 screws per stiffener or bent plate
Joist cantilever to wood sill per Figure 5505.3.1(5)	Steel plate spaced at 3" o.c., with 4-No. 8 screws and 4-10d or 6-8d common nails	Steel plate spaced at 2" o.c., with 4-No. 8 screws and 4-10d or 6-8d common nails
Joist cantilever to foundation per Figure 5505.3.1(6)	½" minimum diameter anchor bolt and clip angle spaced at 6" o.c. with 8-No. 8 screws	½" minimum diameter anchor bolt and clip angle spaced at 4" o.c. with 8-No. 8 screws

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 1.609 km/h.

- a. Anchor bolts shall be located not more than 12 inches from corners or the termination of bottom tracks (e.g., at door openings). Bolts shall extend a minimum of 15 inches into masonry or seven inches into concrete.
- b. All screw sizes shown are minimum.

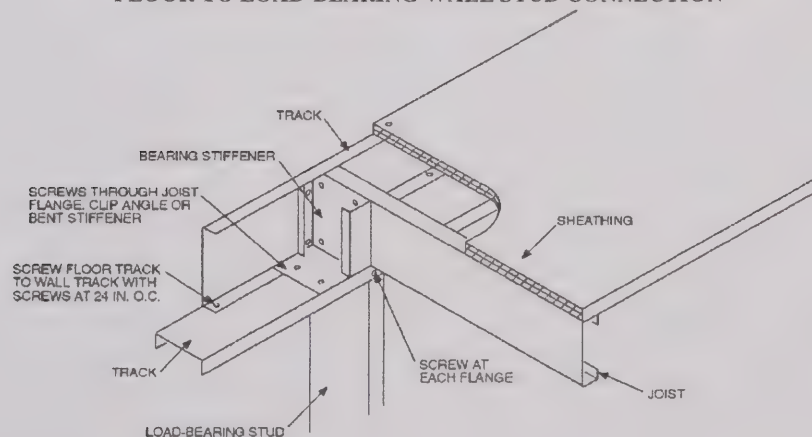
780 CMR TABLE 5505.3.1(2)
FLOOR FASTENING SCHEDULE^a

DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND SIZE OF FASTENERS	SPACING OF FASTENERS
Floor joist to track of an interior load-bearing wall per Figures 5505.3.1(7) and 5505.3.1(8)	2 No. 8 screws	Each joist
Floor joist to track at end of joist	2 No. 8 screws	One per flange or two per bearing stiffener
Subfloor to floor joists	No. 8 screws	6" o.c. on edges and 10" o.c. at intermediate supports

For SI: 1 inch = 25.4 mm.

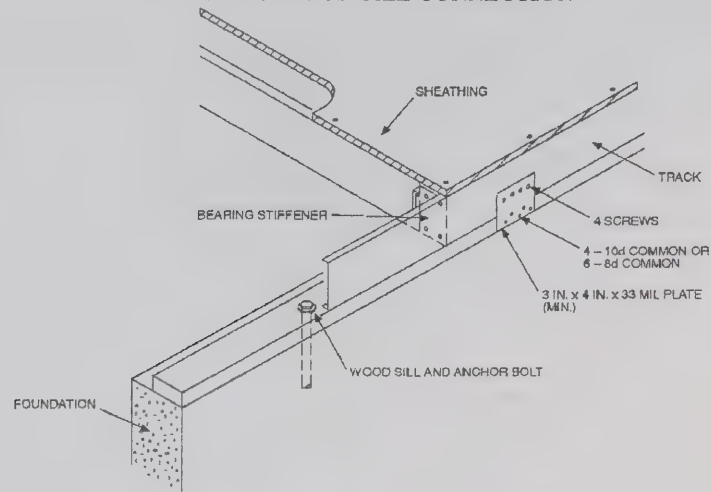
- a. All screw sizes shown are minimum.

780 CMR FIGURE 5505.3.1(1)
FLOOR TO LOAD-BEARING WALL STUD CONNECTION



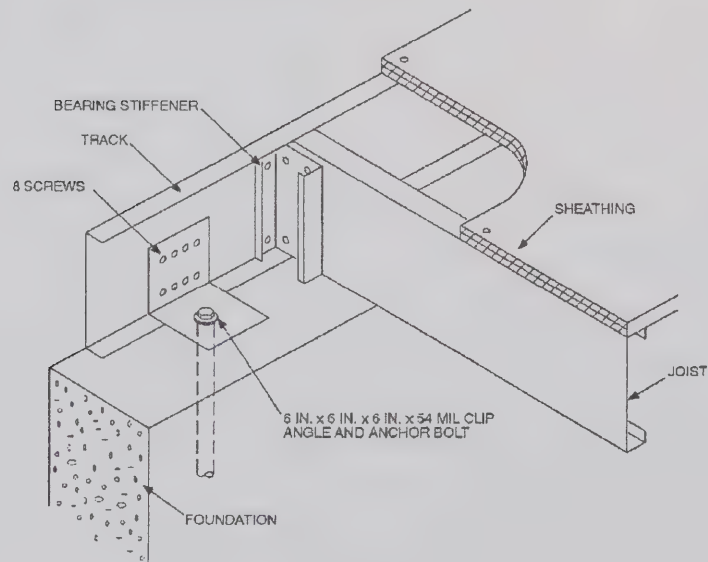
For SI: 1 inch = 25.4 mm, 1 mil = 0.0254 mm.

**780 CMR FIGURE 5505.3.1(2)
FLOOR TO WOOD SILL CONNECTION**



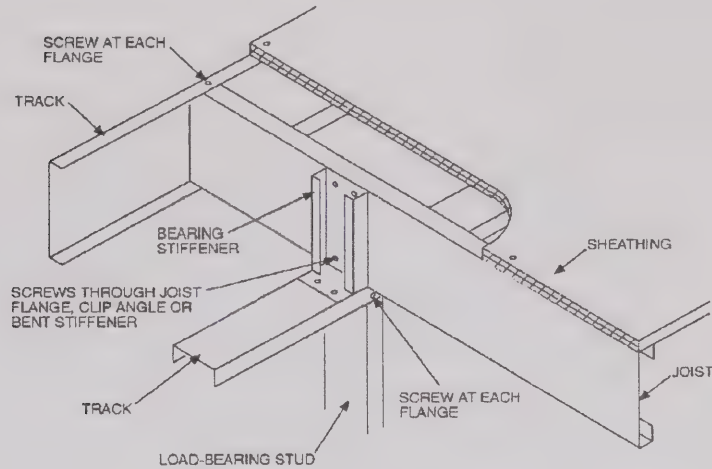
For SI: 1 inch = 25.4 mm, 1 mil = 0.0254 mm.

**780 CMR FIGURE 5505.3.1(3)
FLOOR TO FOUNDATION CONNECTION**



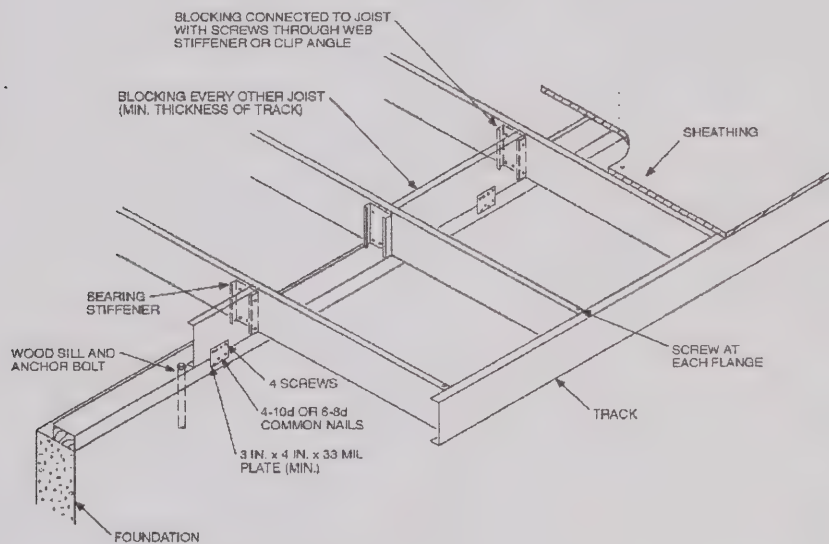
For SI: 1 inch = 25.4 mm, 1 mil = 0.0254 mm.

780 CMR FIGURE 5505.3.1(4)
FLOOR CANTILEVER TO LOAD-BEARING WALL CONNECTION



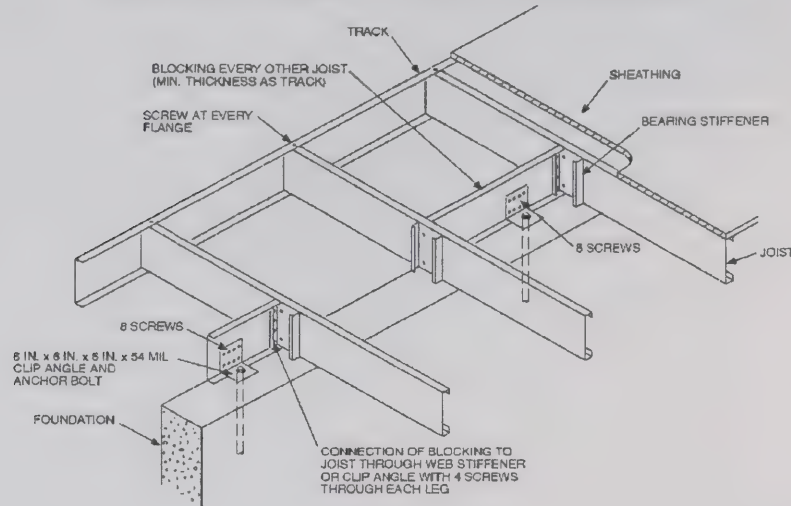
For SI: 1 inch = 25.4 mm, 1 mil = 0.0254 mm.

780 CMR FIGURE 5505.3.1(5)
FLOOR CANTILEVER TO WOOD SILL CONNECTION



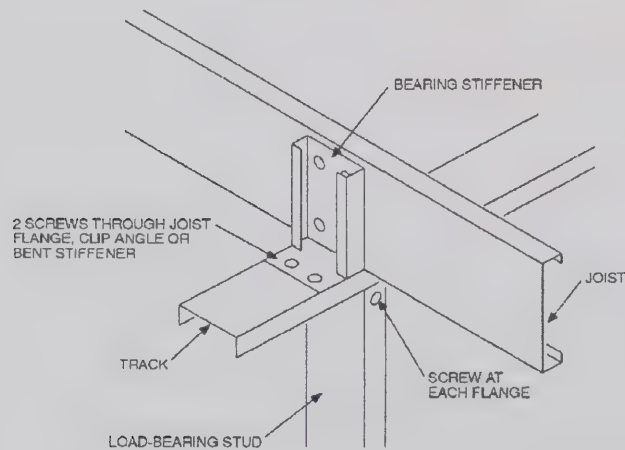
For SI: 1 inch = 25.4 mm, 1 mil = 0.0254 mm.

780 CMR FIGURE 5505.3.1(6)
FLOOR CANTILEVER TO FOUNDATION CONNECTION

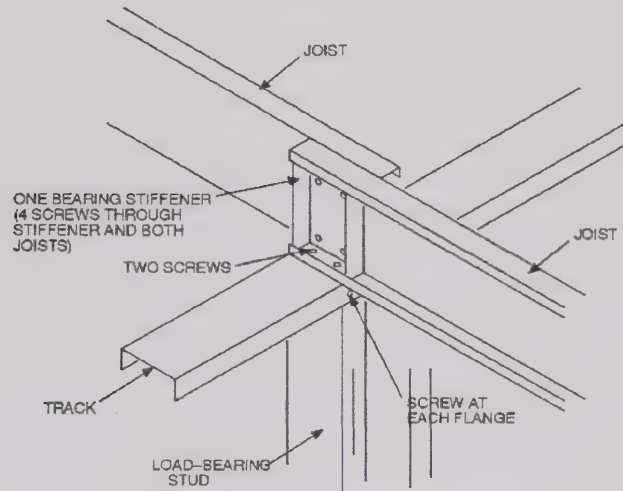


For SI: 1 inch = 25.4 mm, 1 mil = 0.0254 mm.

780 CMR FIGURE 5505.3.1(7)
CONTINUOUS JOIST SPAN SUPPORTED ON STUD



780 CMR FIGURE 5505.3.1(8)
LAPPED JOISTS SUPPORTED ON STUD



780 CMR TABLE 5505.3.2
ALLOWABLE SPANS FOR COLD-FORMED STEEL JOISTS^{a,b}

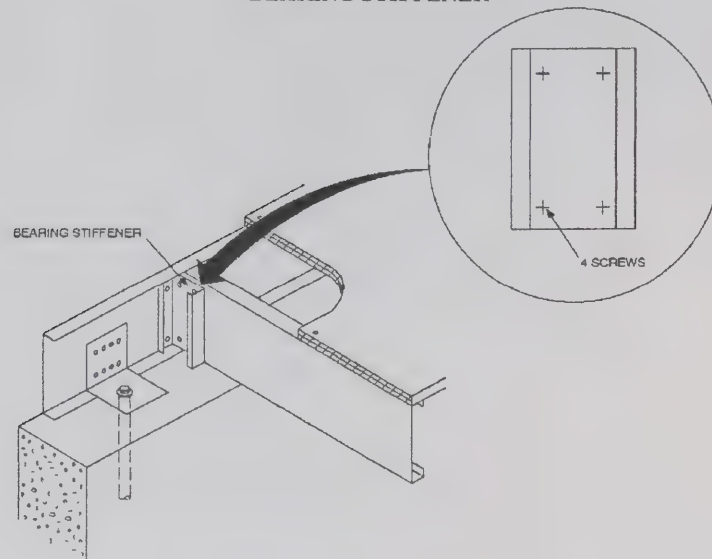
NOMINAL JOIST SIZE	30 PSF LIVE LOAD		40 PSF LIVE LOAD	
	Spacing (inches)		Spacing (inches)	
	16	24	16	24
550S162-33	10'-7"	9'-1"	9'-7"	8'-1"
550S162-43	11'-6"	10'-0"	10'-5"	9'-1"
550S 162-54	12'-4"	10'-9"	11'-2"	9'-9"
550S162-68	13'-2"	11'-6"	12'-0"	10'-6"
800S162-33	13'-3"	8'-10"	10'-7"	7'-1"
800S162-43	15'-6"	13'-7"	14'-1"	12'-3"
800S162-54	16'-8"	14'-7"	15'-2"	13'-3"
800S162-68	17'-11"	15'-7"	16'-3"	14'-2"
1000S162-43	18'-8"	15'-3"	16'-8"	13'-1"
1000S162-54	20'-1"	17'-6"	18'-3"	15'-11"
1000S 162-68	21'-6"	18'-10"	19'-7"	17'- 1"
1200S162-43	20'-3"	14'-1"	16'-10"	11'-3"
1200S162-54	23'-4"	19'-7"	21'-3"	17'-6"
1200S162-68	25'-1"	21'-11"	22'-10"	19'-11"

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kN/m².

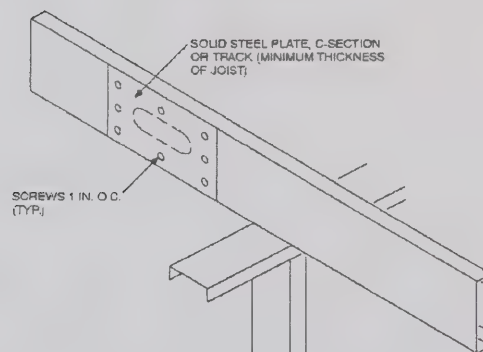
a. Deflection criteria: $L/480$ for live loads, $L/360$ for total loads.

b. Floor dead load - 10 psf.

**780 CMR FIGURE 5505.3.4
BEARING STIFFENER**

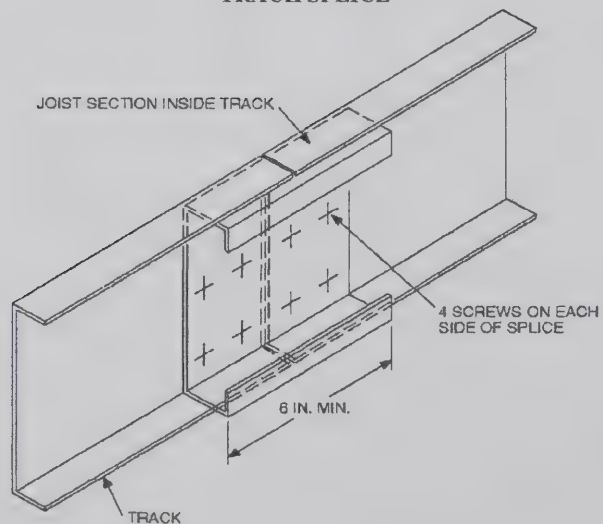


**780 CMR FIGURE 5505.3.6
HOLE PATCH**



For SI: 1 inch = 25.4 mm.

**780 CMR FIGURE 5505.3.8
TRACK SPLICE**



For SI: 1 inch = 25.4 mm.

780 CMR 5506 CONCRETE FLOORS (ON GROUND)

5506.1 General. Concrete slab-on-ground floors shall be a minimum 3.5 inches (89 mm) thick (for expansive soils, see 780 CMR 5403.1.8). The specified compressive strength of concrete shall be as set forth in 780 CMR 5402.2.

5506.1.2 Control Joints. *Slabs shall be constructed with control joints having a depth of at least one quarter of the slab thickness but not less than one inch (25 mm). Joints shall be spaced at intervals not greater than 30 feet (9144 mm) in each direction. Control joints shall be placed at locations where the slab width or length changes.*

Exception: Control joints may be omitted when the slab is reinforced in accordance with Table 5506.1.2. Reinforcement shall be placed at the mid-depth of the slab or two inches (51 mm) from the top of slabs greater than four inches (102 mm) in thickness.

780 CMR TABLE 5506.1.2

MAXIMUM DIMENSION OF SLAB OR DISTANCE BETWEEN CONTROL JOINTS (feet)						WWF ² WIRE SPACING (inches)	WWF ² WIRE SIZE DESIGNATION (inches)
SLAB THICKNESS (inches)							
3.5	4	4.5	5	5.5	6		
42	36	32	29	26	24	6 x 6	W1.4 x W1.4
59	52	46	42	38	35	6 x 6	W2.0 x W2.0
86	75	67	60	55	50	6 x 6	W2.9 x W2.9

5506.2 Site Preparation. The area within the foundation walls shall have all vegetation, top soil and foreign material removed.

5506.2.1 Fill. Fill material shall be free of *organic material*, vegetation and foreign material. The fill shall be compacted to assure uniform support of the slab, and except where approved, the fill depths shall not exceed 24 inches (610 mm) for clean sand or gravel.

5506.2.2 Base. A four-inch-thick (102 mm) base course consisting of clean graded sand, gravel, crushed stone or crushed blast-furnace slag passing a two-inch (51 mm) sieve shall be placed on the prepared subgrade when the slab is below grade.

Exception: A base course is not required when the concrete slab is installed on well-drained or sand-gravel mixture soils classified as Group I according to the United Soil Classification System in accordance with Table R405.1.

5506.2.3 Vapor Retarder. A six mil (0.006 inch; 152 µm) polyethylene or approved vapor retarder with joints lapped not less than six inches (152mm) shall be placed between the concrete floor slab and the base course or the prepared subgrade where no base course exists.

Exception: The vapor retarder may be omitted:

1. From garages, utility buildings and other unheated accessory structures.
2. *In accordance with the requirements of 780 CMR 61.00.*

WALL CONSTRUCTION

780 CMR 5601 GENERAL

5601.1 Application. The provisions of 780 CMR 56.00 shall control the design and construction of all walls and partitions for all buildings.

5601.2 Requirements. Wall construction shall be capable of accommodating all loads imposed according to 780 CMR 5301 and of transmitting the resulting loads to the supporting structural elements.

5601.2.1 Compressible Floor-covering Materials. Compressible floor-covering materials that compress more than $\frac{1}{32}$ inch (0.794 mm) when subjected to 50 pounds (23 kg) applied over one inch square (645 mm) of material and are greater than $\frac{1}{8}$ inch (3.2 mm) in thickness in the uncompressed state shall not extend beneath walls, partitions or columns, which are fastened to the floor.

780 CMR 5602 WOOD WALL FRAMING

5602.1 Identification. Load-bearing dimension lumber for studs, plates and headers shall be identified by a grade mark of a lumber grading or inspection agency that has been approved by an accreditation body that complies with DOC PS 20. In lieu of a grade mark, a certification of inspection issued by a lumber grading or inspection agency meeting the requirements of 780 CMR 5602 shall be accepted.

5602.1.1 End-jointed Lumber. Approved end-jointed lumber identified by a grade mark conforming to 780 CMR 5602.1 may be used interchangeably with solid-sawn members of the same species and grade.

5602.1.2 Structural Glued Laminated Timbers. Glued laminated timbers shall be manufactured and identified as required in AITC A190.1 and ASTM D3737.

5602.2 Grade. Studs shall be a minimum No. 3, standard or stud grade lumber.

Exception: Bearing studs not supporting floors and nonbearing studs may be utility grade lumber, provided the studs are spaced in accordance with 780 CMR Table 5602.3(5).

5602.3 Design and Construction. Exterior walls of wood-frame construction shall be designed and constructed in accordance with the provisions of 780 CMR 56.00 and 780 CMR Figures 5602.3(1) and 5602.3(2) or in accordance with AF&PA's NDS. Components of exterior walls shall be fastened in accordance with 780 CMR Table 5602.3(1) through 5602.3(4). Exterior walls covered with foam plastic sheathing shall be braced in accordance with 780 CMR 5602.10. Structural sheathing shall be

fastened directly to structural framing members.

5602.3.1 Stud Size, Height and Spacing. The size, height and spacing of studs shall be in accordance with 780 CMR Table 5602.3.(5).

Exceptions:

1. Utility grade studs shall not be spaced more than 16 inches (406 mm) on center, shall not support more than a roof and ceiling, and shall not exceed eight feet (2438 mm) in height for exterior walls and load-bearing walls or ten feet (3048 mm) for interior nonload-bearing walls.
2. Studs more than ten feet (3048 mm) in height which are in accordance with 780 CMR Table 5602.3.1.

5602.3.2 Top Plate. Wood stud walls shall be capped with a double top plate installed to provide overlapping at corners and intersections with bearing partitions. End joints in top plates shall be offset at least 24 inches (610 mm). Plates shall be a nominal two inches in depth (51 mm) and have a width at least equal to the width of the studs.

Exception: A single top plate may be installed in stud walls, provided the plate is adequately tied at joints, corners and intersecting walls by a minimum three-inch-by-six-inch by a 0.036-inch-thick (76 mm by 152 mm by 0.9 14 mm) galvanized steel plate that is nailed to each wall or segment of wall by six 8d nails on each side, provided the rafters or joists are centered over the studs with a tolerance of no more than one inch (25.4 mm). The top plate may be omitted over lintels that are adequately tied to adjacent wall sections with steel plates or equivalent as previously described.

5602.3.3 Bearing Studs. Where joists, trusses or rafters are spaced more than 16 inches (406 mm) on center and the bearing studs below are spaced 24 inches (610 mm) on center, such members shall bear within five inches (127 mm) of the studs beneath.

Exceptions:

1. The top plates are two two-inch by six-inch (38 mm by 140 mm) or two three-inch by four-inch (64 mm by 89 mm) members.
2. A third top plate is installed.
3. Solid blocking equal in size to the studs is installed to reinforce the double top plate.

5602.3.4 Bottom (Sole) Plate. Studs shall have full bearing on a nominal two by (38 mm) or larger plate or sill having a width at least equal to the width of the studs.

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780 CMR TABLE 5602.3(1)
FASTENER SCHEDULE FOR STRUCTURAL MEMBERS

DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER ^{a,b,c,d}	SPACING OF FASTENERS
Joist to sill or girder, toe nail	3-8d	—
1" x 6" subfloor or less to each joist, face nail	2-8d 2 staples, 1¾"	—
2" subfloor to joist or girder, blind and face nail	2-16d	—
Sole plate to joist or blocking, face nail	16d	16" o.c.
Top or sole plate to stud, end nail	2-16d	—
Stud to sole plate, toe nail	3-8d or 2-16d	—
Double studs, face nail	10d	24" o.c.
Double top plates, face nail	10d	24" o.c.
Sole plate to joist or blocking at braced wall panels	3-16d	16" o.c.
Double top plates, minimum 24-inch offset of end joints, face nail in lapped area	8- 16d	—
Blocking between joists or rafters to top plate, toe nail	3-8d	—
Rim joist to top plate, toe nail	8d	6" o.c.
Top plates, laps at corners and intersections, face nail	2-10d	—
Built-up header, two pieces with ½" spacer	16d	16" o.c. along each edge
Continued header, two pieces	16d	16" o.c. along each edge
Ceiling joists to plate, toe nail	3-8d	—
Continuous header to stud, toe nail	4-8d	—
Ceiling joist, laps over partitions, face nail	3-10d	—
Ceiling joist to parallel rafters, face nail	3-10d	—
Rafter to plate, toe nail	2-16d	—
1" brace to each stud and plate, face nail	2-8d 2 staples, 1¾"	—
1" x 6" sheathing to each bearing, face nail	2-8d 2 staples, 1¾"	—
1" x 8" sheathing to each bearing, face nail	2-8d 3 staples, 1¾"	—
Wider than 1" x 8" sheathing to each bearing, face nail	3-8d 4 staples, 1¾"	—
Built-up corner studs	10d	24" o.c.
Built-up girders and beams, 2-inch lumber layers	10d	Nail each layer as follows: 32" o.c. at top and bottom and staggered. Two nails at ends and at each splice.
2" planks	2-16d	At each bearing
Roof rafters to ridge, valley or hip rafters: toe nail	4-16d	—
face nail	3-16d	—
Rafter ties to rafters, face	3-8d	—

780 CMR TABLE 5602.3(1) - continued
FASTENER SCHEDULE FOR STRUCTURAL MEMBERS

DESCRIPTION OF BUILDING MATERIALS	DESCRIPTION OF FASTENER ^{b,c,d,e}	SPACING OF FASTENERS	
		Edges (inches)	Intermediate supports ^{c,*} (inches)
Wood structural panels, subfloor, roof and wall sheathing to framing, and particleboard wall sheathing to framing			
⁵ / ₁₆ " - 1/2"	6d common nail (subfloor, wall) 8d common nail (roof) ^f	6	12 ^g
¹⁹ / ₃₂ " - 1 "	8d common nail	6	12 ^g
1 1/8" - 1 1/4"	10d common nail or 8d deformed nail	6	12
Other wall sheathing ^h			
1/2" regular cellulosic fiberboard sheathing	1 " galvanized roofing nail 6d common nail staple 16 ga., 1 1/2 long	3	6
1/2" structural cellulosic fiberboard sheathing	1 1/2" galvanized roofing nail 8d common nail staple 16 ga., 1 1/2 long	3	6
²⁵ / ₃₂ " structural cellulosic fiberboard sheathing	1 3/4 galvanized roofing nail 8d common nail staple 16 ga., 1 3/4 long	3	6
1/2" gypsum sheathing	1 1/2" galvanized roofing nail; 6d common nail; staple galvanized, 1 1/2 long; 1 1/4 screws, Type W or S	4	8
5/8" gypsum sheathing	1 3/4" galvanized roofing nail; 8d common nail; staple galvanized, 1 5/8" long; 1 5/8" screws, Type W or S	4	8
Wood structural panels, combination subfloor underlayment to framing			
3/4" and less	6d deformed nail or 8d common nail	6	12
7/8" - 1 "	8d common nail or 8d deformed nail	6	12
1 1/8" - 1 1/4"	10d common nail or 8d deformed nail	6	12

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 1.609 km/h.

- All nails are smooth-common, box or deformed shanks except where otherwise stated. Nails used for framing and sheathing connections shall have minimum average bending yield strengths as shown: 80 ksi (551 MPa) for shank diameter of 0.192 inch (20d common nail), 90 ksi (620 MPa) for shank diameters larger than 0.142 inch but not larger than 0.177 inch, and 100 ksi (689 MPa) for shank diameters of 0.142 inch or less.
- Staples are 16 gage wire and have a minimum ⁷/₁₆-inch on diameter crown width.
- Nails shall be spaced at not more than six inches on center at all supports where spans are 48 inches or greater.
- Four-foot-by-eight-foot or four-foot-by-nine-foot panels shall be applied vertically.
- Spacing of fasteners not included in this table shall be based on 780 CMR Table 5602.3(2).
- For regions having basic wind speed of 110 mph or greater, 8d deformed nails shall be used for attaching plywood and wood structural panel roof sheathing to framing within minimum 48-inch distance from gable end walls, if mean roof height is more than 25 feet, up to 35 feet maximum.
- For regions having basic wind speed of 100 mph or less, nails for attaching wood structural panel roof sheathing to gable end wall framing shall be spaced six inches on center. When basic wind speed is greater than 100 mph, nails for attaching panel roof sheathing to intermediate supports shall be spaced six inches on center for minimum 48-inch distance from ridges, eaves and gable end walls; and four inches on center to gable end wall framing.
- Gypsum sheathing shall conform to ASTM C 79 and shall be installed in accordance with GA 253. Fiberboard sheathing shall conform to either AHA 194.1 or ASTM C 208.
- Spacing of fasteners on floor sheathing panel edges applies to panel edges supported by framing members and at all floor perimeters only. Spacing of fasteners on roof sheathing panel edges applies to panel edges supported by framing members and at all roof plane perimeters. Blocking of roof or floor sheathing panel edges perpendicular to the framing members shall not be required except at intersection of adjacent roof planes. Floor and roof perimeter shall be supported by framing members or solid blocking.

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780 CMR TABLE 5602.3(2)
ALTERNATE ATTACHMENTS

ALTERNATE ATTACHMENTS			
NOMINAL MATERIAL THICKNESS (inches)	DESCRIPTION ^{a,b} OF FASTENER AND LENGTH (inches)	SPACING ^c OF FASTENERS	
		Edges (inches)	Intermediate supports (inches)
Wood structural panels subfloor, roof and wall sheathing to framing and particleboard wall sheathing to framing ^f			
⁵ / ₁₆	0.097 - 0.099 Nail 1½	6	12
	Staple 15 ga. 1⅜		
	Staple 16 ga. 1¾		
³ / ₈	Staple 15 ga. 1⅜	6	12
	0.097 - 0.099 Nail 1½	4	10
	Staple 16 ga. 1¾	6	12
¹⁵ / ₃₂ and ½	Staple 15 ga. 1½	6	12
	0.097 - 0.099 Nail 1⅝	3	6
	Staple 16 ga. 1¾	6	12
¹⁹ / ₃₂ and ⅝	0.113 Nail 1⅞	6	12
	Staple 15 and 16 ga. 1⅝	3	6
	0.097 - 0.099 Nail 1¾		
²³ / ₃₂ and ¾	Staple 14 ga. 1¾	6	12
	Staple 15 ga. 1¾	5	10
	0.097 - 0.099 Nail 1⅞	3	6
	Staple 16 ga. 2	4	8
	Staple 14 ga. 2	5	10
1	0.113 Nail 2¼, Staple 15 ga. 2	4	8
	0.097 - 0.099 Nail 2⅝	3	6
NOMINAL MATERIAL THICKNESS (inches)	DESCRIPTION ^{a,b} OF FASTENER AND LENGTH (inches)	SPACING ^c OF FASTENERS	
		Edges (inches)	Body of panel ^d (inches)
Floor underlayment; plywood-hardboard-particleboard ^f			
Plywood			
^¼ and ⁵ / ₁₆	1¼ ring or screw shank nail—minimum 12½ ga. (0.099") shank diameter	3	6
	Staple 18 ga., ⅞, ³ / ₁₆ crown width	2	5
	¹¹ / ₃₂ , ³ / ₈ , ¹⁵ / ₃₂ and ½	1¼ ring or screw shank nail—minimum 12½ ga. (0.099) shank diameter	6
¹⁹ / ₃₂ , ⁵ / ₈ , ²³ / ₃₂ and ¾	1½ ring or screw shank nail—minimum 12½ ga. (0.099) shank diameter	6	12
	Staple 16 ga. 1¼	6	8
Hardboard ^f			
0.200	1½ long ring-grooved underlayment nail	6	6
	4d cement-coated sinker nail	6	6
	Staple 18 ga., ⅞ long (plastic coated)	3	6
Particleboard			
^¼	4d ring-grooved underlayment nail	3	6
	Staple 18 ga., ⅞ long, ³ / ₁₆ crown	3	6
³ / ₈	6d ring-grooved underlayment nail	6	10
	Staple 16 ga., 1⅞ long, ³ / ₈ crown	3	6
^½ , ⁵ / ₈	6d ring-grooved underlayment nail	6	10
	Staple 16 ga., 1⅞ long, ³ / ₈ crown	3	6

For SI: 1 inch = 25.4 mm.

a. Nail is a general description and may be T-head, modified round head or round head.

b. Staples shall have a minimum crown width of $\frac{7}{16}$ -inch on diameter except as noted.

c. Nails or staples shall be spaced at not more than six inches on center at all supports where spans are 48 inches or greater. Nails or staples shall be spaced at not more than 12 inches on center at intermediate supports for floors.

d. Fasteners shall be placed in a grid pattern throughout the body of the panel.

e. For 5-ply panels, intermediate nails shall be spaced not more than 12 inches on center each way.

f. Hardboard underlayment shall conform to ANSI/AHA A135.4.

780 CMR TABLE 5602.3(3)

ALLOWABLE STUD SPACING FOR WOOD STRUCTURAL PANEL WALL SHEATHING

PANEL SPAN RATING	PANEL NOMINAL THICKNESS (inch)	MAXIMUM STUD SPACING (inches)	
		Siding nailed to: ^a	
		Stud	Sheathing
12/0, 16/0, 20/0, or wall —16 o.c.	$\frac{5}{16}$, $\frac{3}{8}$	16	16 ^b
24/0, 24/16, 32/16 or wall—24 o.c.	$\frac{3}{8}$, $\frac{7}{16}$, $\frac{15}{32}$, $\frac{1}{2}$	24	24 ^c

For SI: 1 inch = 25.4 mm.

- Blocking of horizontal joints shall not be required.
- Plywood sheathing $\frac{3}{8}$ -inch thick or less shall be applied with long dimension across studs.
- Three-ply plywood panels shall be applied with long dimension across studs.

780 CMR TABLE 5602.3(4)

ALLOWABLE SPANS FOR PARTICLEBOARD WALL SHEATHING^a

THICKNESS (inch)	GRADE	STUD SPACING (inches)	
		When siding is nailed to studs	When siding is nailed to sheathing
$\frac{3}{8}$	M-1 Exterior glue	16	—
$\frac{1}{2}$	M-2 Exterior glue	16	16

For SI: 1 inch = 25.4 mm.

- Wall sheathing not exposed to the weather. If the panels are applied horizontally, the end joints of the panel shall be offset so that four panels corners will not meet. All panel edges must be supported. Leave a $\frac{1}{16}$ -inch gap between panels and nail no closer than $\frac{3}{8}$ inch from panel edges.

780 CMR TABLE 5602.3(5)

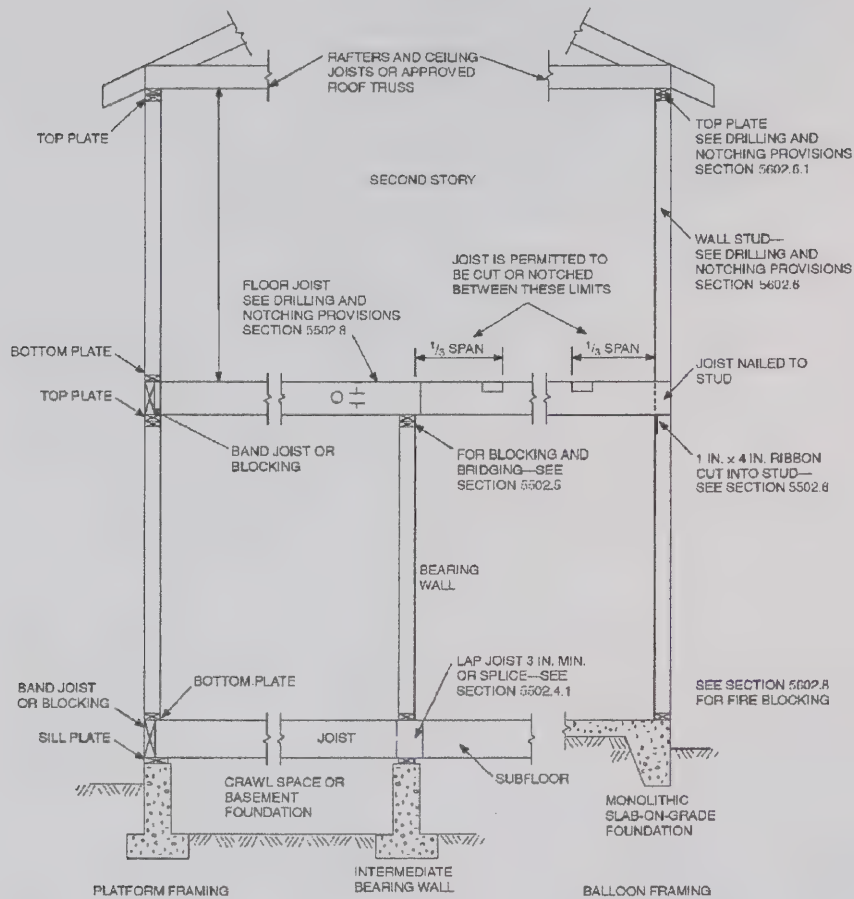
SIZE, HEIGHT AND SPACING OF WOOD STUDS^a

STUD SIZE (inches)	BEARING WALLS					NONBEARING WALLS	
	Laterally unsupported stud height ^a (feet)	Maximum spacing when supporting roof and ceiling only (inches)	Maximum spacing when supporting one floor, roof and ceiling (inches)	Maximum spacing when supporting two floors, roof and ceiling (inches)	Maximum spacing when supporting one floor only (inches)	Laterally unsupported stud height ^a (feet)	Maximum spacing (inches)
2x 3 ^b	—	—	—	—	—	10	16
2x 4	10	24	16	—	24	14	24
3x 4	10	24	24	16	24	14	24
2x 5	10	24	24	—	24	16	24
2x 6	10	24	24	16	24	20	24

For SI: 1 inch = 25.4 mm.

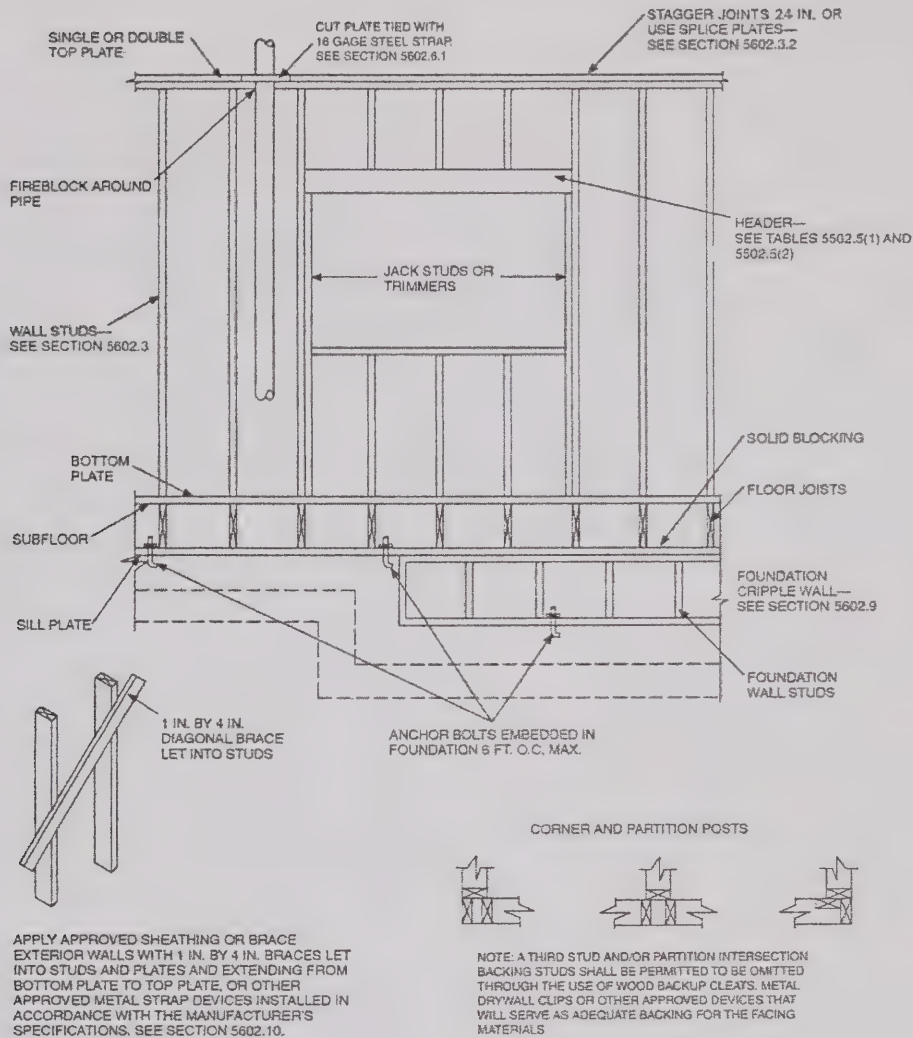
- Listed heights are distances between points of lateral support placed perpendicular to the plane of the wall. Increases in unsupported height are permitted where justified by analysis.
- Shall not be used in exterior walls.

780 CMR FIGURE 5602.3(1)
TYPICAL WALL, FLOOR AND ROOF FRAMING



For SI: 1 inch = 25.4 mm.

780 CMR FIGURE 5602.3(2)
FRAMING DETAILS



For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

780 CMR TABLE 5602.3.1

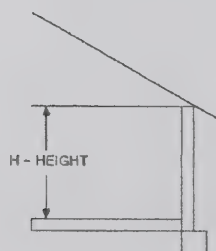
MAXIMUM ALLOWABLE LENGTH OF WOOD WALL STUDS EXPOSED TO
WIND SPEEDS OF 100 MPH OR LESS IN SEISMIC DESIGN CATEGORIES A, B, C and D₁^{b,c}

HEIGHT (feet)	ON-CENTER SPACING (inches)			
	24	16	12	8
Supporting a roof only				
>10	2 × 4	2 × 4	2 × 4	2 × 4
12	2 × 6	2 × 4	2 × 4	2 × 4
14	2 × 6	2 × 6	2 × 6	2 × 4
16	2 × 6	2 × 6	2 × 6	2 × 4
18	NA ^a	2 × 6	2 × 6	2 × 6
20	NA ^a	NA ^a	2 × 6	2 × 6
24	NA ^a	NA ^a	NA ^a	2 × 6
Supporting one floor and a roof				
>10	2 × 6	2 × 4	2 × 4	2 × 4
12	2 × 6	2 × 6	2 × 6	2 × 4
14	2 × 6	2 × 6	2 × 6	2 × 6
16	NA ^a	2 × 6	2 × 6	2 × 6
18	NA ^a	2 × 6	2 × 6	2 × 6
20	NA ^a	NA ^a	2 × 6	2 × 6
24	NA ^a	NA ^a	NA ^a	2 × 6
Supporting two floors and a roof				
>10	2 × 6	2 × 6	2 × 4	2 × 4
12	2 × 6	2 × 6	2 × 6	2 × 6
14	2 × 6	2 × 6	2 × 6	2 × 6
16	NA ^a	NA ^a	2 × 6	2 × 6
18	NA ^a	NA ^a	2 × 6	2 × 6
20	NA ^a	NA ^a	NA ^a	2 × 6
22	NA ^a	NA ^a	NA ^a	NA ^a
24	NA ^a	NA ^a	NA ^a	NA ^a

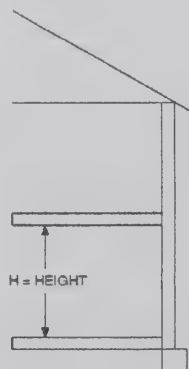
For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kN/m²,

1 pound per square inch = 6.895 kPa, 1 mile per hour = 1.609 km/h.

- Design required.
- Applicability of this table assumes the following: Snow load not exceeding 25 psf, f_b not less than 1310 psi determined by multiplying the AF&PA NDS tabular base design value by the repetitive use factor, and by the size factor for all species except southern pine, E not less than 1.6 by 10⁶ psi, tributary dimensions for floors and roofs not exceeding six feet, maximum span for floors and roof not exceeding 12 feet, eaves not greater than two feet in dimension and exterior sheathing. Where the conditions are not within these parameters, design is required.
- Utility, standard, stud and No. 3 grade lumber of any species are not permitted.

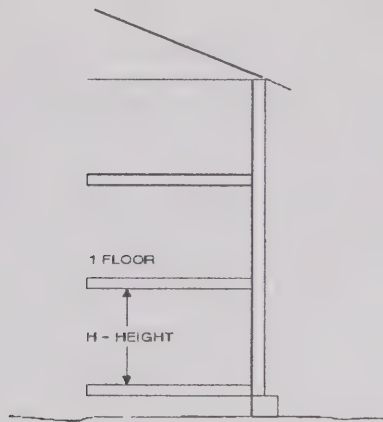


1 ROOF LOAD



1 ROOF LOAD
1 FLOOR LOAD

780 CMR TABLE 5602.3.1—continued
MAXIMUM ALLOWABLE LENGTH OF WOOD WALL STUDS EXPOSED TO
WIND SPEEDS OF 100 MPH OR LESS IN SEISMIC DESIGN CATEGORIES A, B, C and D₁



1 ROOF LOAD
2 FLOOR LOADS

5602.4 Interior Load-bearing Walls. Interior load-bearing walls shall be constructed, framed and fireblocked as specified for exterior walls.

5602.5 Interior Nonbearing Walls. Interior nonbearing walls shall be permitted to be constructed with two-inch-by-three-inch (51 mm by 76 mm) studs spaced 24 inches (610 mm) on center or, when not part of a braced wall line, two-inch-by-four-inch (51 mm by 102 mm) flat studs spaced at 16 inches (406 mm) on center. Interior nonbearing walls shall be capped with at least a single top plate. Interior nonbearing walls shall be fireblocked in accordance with 780 CMR 5602.8.

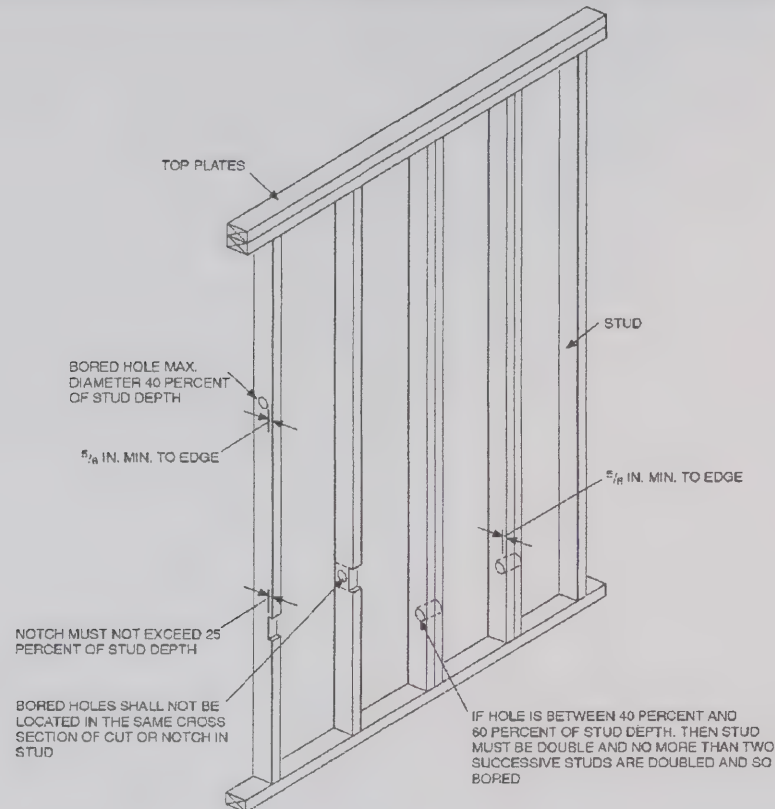
5602.6 Drilling and Notching—Studs. Any stud in an exterior wall or bearing partition may be cut or notched to a depth not exceeding 25% of its width. Studs in nonbearing partitions may be notched to a

depth not to exceed 40% of a single stud width. Any stud may be bored or drilled, provided that the diameter of the resulting hole is no greater than 40% of the stud width, the edge of the hole is no closer than $\frac{5}{8}$ inch (15.9 mm) to the edge of the stud, and the hole is not located in the same section as a cut or notch. See 780 CMR Figures 5602.6(1) and 5602.6(2).

Exceptions:

1. A stud may be bored to a diameter not exceeding 60% of its width, provided that such studs located in exterior walls or bearing partitions are doubled and that not more than two successive studs are bored.
2. Approved stud shoes may be used when installed in accordance with the manufacturer's recommendation.

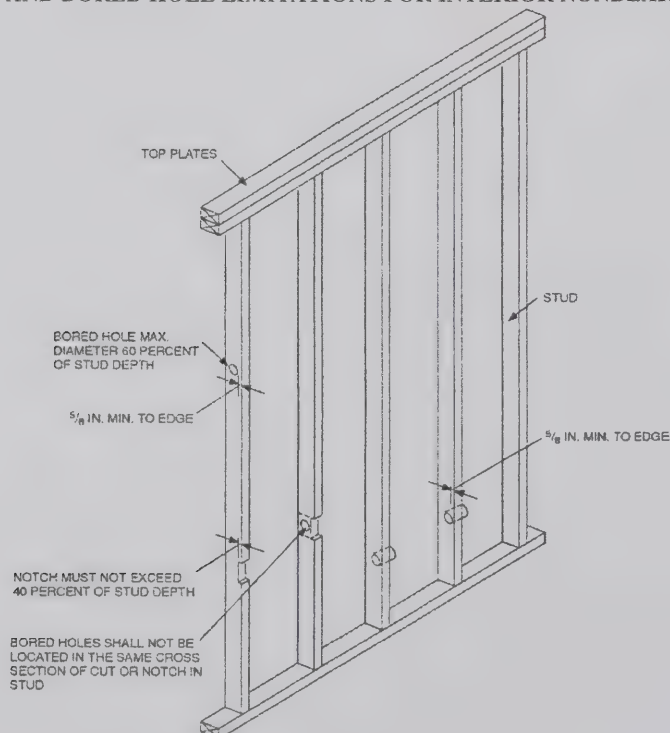
780 CMR FIGURE 5602.6(1)
NOTCHING AND BORED HOLE LIMITATIONS FOR EXTERIOR WALLS AND BEARING WALLS



For SI: 1 inch = 25.4 mm.

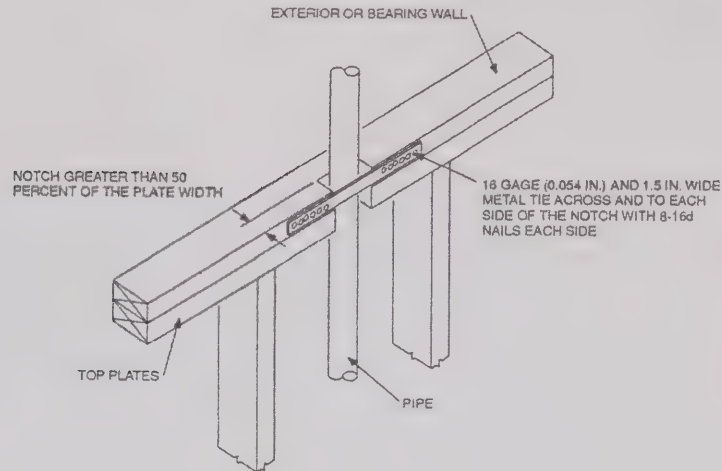
NOTE: Condition for exterior and bearing walls.

780 CMR FIGURE 5602.6(2)
NOTCHING AND BORED HOLE LIMITATIONS FOR INTERIOR NONBEARING WALLS



For SI: 1 inch = 25.4 mm.

**780 CMR FIGURE 5602.6.1
TOP PLATE FRAMING TO ACCOMMODATE PIPING**



For SI: 1 inch = 25.4 mm.

5602.6.1 Drilling and Notching of Top Plate.

When piping or ductwork is placed in or partly in an exterior wall or interior load-bearing wall, necessitating cutting, drilling or notching of the top plate by more than 50% of its width, a galvanized metal tie of not less than 0.054 inches thick (1.37 mm) (16 ga) and 1½ inches (38 mm) wide shall be fastened to each plate across and to each side of the opening with not less than eight 16d nails at each side or equivalent. See 780 CMR Figure 5602.6.1.

Exception: When the entire side of the wall with the notch or cut is covered by wood structural panel sheathing.

5602.7 Headers. For header spans see 780 CMR Tables 5502.5(1) and 5502.5(2).

5602.7.1 Wood Structural Panel Box Headers. Wood structural panel box headers shall be constructed in accordance with 780 CMR Figure 5602.7.2 and 780 CMR Table 5602.7.2.

5602.7.2 Nonbearing Walls. Load-bearing headers are not required in interior or exterior nonbearing walls. A single flat two-inch-by-four-inch (51 mm by 102 mm) member may be used as a header in interior or exterior nonbearing walls for openings up to eight feet (2438 mm) in width if the vertical distance to the parallel nailing surface above is not more than 24 inches (610 mm). For such nonbearing headers, no cripples or blocking are required above the header.

5602.8 Fireblocking Required. Fireblocking shall be provided to cut off all concealed draft openings (both vertical and horizontal) and to form an effective fire barrier between stories, and between a top story and the roof space. Fireblocking shall be provided in wood-frame construction in the

following locations.

1. In concealed spaces of stud walls and partitions, including furred spaces and parallel rows of studs or staggered studs; as follows:

- 1.1. Vertically at the ceiling and floor levels.
- 1.2. Horizontally at intervals not exceeding ten feet (3048 mm).

2. At all interconnections between concealed vertical and horizontal spaces such as occur at soffits, drop ceilings and cove ceilings.

3. In concealed spaces between stair stringers at the top and bottom of the run. Enclosed spaces under stairs shall comply with 780 CMR 3511.2.2.

4. At openings around vents, pipes, and ducts at ceiling and floor level, with an approved material to resist the free passage of flame and products of combustion.

5. For the fireblocking of chimneys and fireplaces, see 780 CMR 6001.16.

6. Fireblocking of cornices of a two-family dwelling is required at the line of dwelling unit separation.

5602.8.1 Materials. Except as provided in 780 CMR 5602.8, Item 4, fireblocking shall consist of two-inch (51 mm) nominal lumber, or two thicknesses of one-inch (25.4 mm) nominal lumber with broken lap joints, or one thickness of 23/32-inch (19.8 mm) wood structural panels with joints backed by 23/32-inch (19.8 mm) wood structural panels or one thickness of ¾-inch (19.1 mm) particleboard with joints backed by ¾-inch (19.1 mm) particleboard, ½-inch (12.7 mm) gypsum board, or ¼-inch (6.4 mm) cement-based millboard. Batts or blankets of mineral wool or glass fiber or other approved materials installed in such a manner as to be securely retained in place shall be permitted as an acceptable fire block. Batts or blankets of mineral or glass fiber or other

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approved non-rigid materials shall be permitted for compliance with the ten foot horizontal fireblocking in walls constructed using parallel rows of studs or staggered studs. Loose-fill insulation material shall not be used as a fire block unless specifically tested in the form and manner intended for use to demonstrate its ability to remain in place and to retard the spread of fire and hot gases.

5602.8.1.1 Unfaced Fiberglass. Unfaced fiberglass batt insulation used as fireblocking shall fill the entire cross section of the wall cavity to a minimum height of 16 inches (406 mm) measured vertically. When piping, conduit or similar obstructions are encountered, the insulation shall be packed tightly around the obstruction.

5602.8.1.2 Fireblocking Integrity. The integrity of all fireblocks shall be maintained.

5602.9 Cripple Walls. Foundation cripple walls shall be framed of studs not less in size than the studding above. When exceeding four feet (1219 mm) in height, such walls shall be framed of studs having the size required for an additional story.

Cripple walls with a stud height less than 14 inches (356 mm) shall be sheathed on at least one side with a wood structural panel that is fastened to both the top and bottom plates in accordance with 780 CMR Table 5602.3(1), or the cripple walls shall be constructed of solid blocking. Cripple walls shall be supported on continuous foundations.

5602.10 Wall Bracing. All exterior walls shall be braced in accordance with 780 CMR 5602. In addition, interior braced wall lines shall be provided in accordance with 780 CMR 5602.10.1.1.

5602.10.1 Braced wall lines. Braced wall lines shall consist of braced wall panel construction methods in accordance with 780 CMR 5602.10.3. The amount and location of bracing shall be in accordance with 780 CMR Table 5602.10.1. Braced wall panels shall begin no more than 12.5 feet (3810 mm) from each end of a braced wall line. Braced wall panels that are counted as part of a braced wall line shall be in line, except that offsets out-of-plane of up to four feet (1219 mm) shall be permitted provided that the total out-to-out offset dimension in any braced wall line is not more than eight feet (2438 mm).

A designed collector shall be provided if the bracing begins more than 12 feet (3658 mm) from each end of a braced wall line.

5602.10.1.1 Spacing. Spacing of braced wall lines shall not exceed 35 feet (10,668 mm) on center in both the longitudinal and transverse directions in each story.

Exception: Spacing of braced wall lines not exceeding 50 feet shall be permitted where:

1. The wall bracing provided equals or exceeds the amount of bracing required by 780 CMR Table 5602.10.1 multiplied by a factor equal to the braced wall line spacing divided by 35 feet, and
2. The length-to-width ratio for the floor/wall diaphragm does not exceed 3:1.

5602.10.2 Cripple Wall Bracing.

5602.10.2.1 Cripple Wall Bracing for Basic Wind Speeds. Cripple walls shall be braced with an amount and type of bracing as required for the wall above in accordance with 780 CMR Table 5602.10.1.

5602.10.2.2 Seismic Design. *Not applicable for one-and two-family dwellings.*

5602.10.2.3 Redesignation of Cripple Walls. Cripple walls are permitted to be redesignated as the first story walls for purposes of determining wall bracing requirements. If the cripple walls are redesignated, the stories above the redesignated story shall be counted as the second and third stories respectively.

5602.10.3 Braced Wall Panel Construction Methods. The construction of braced wall panels shall be in accordance with one of the following methods:

1. Nominal one-inch-by-four-inch (25.4 mm by 102 mm) continuous diagonal braces let in to the top and bottom plates and the intervening studs or approved metal strap devices installed in accordance with the manufacturer's specifications. The let-in bracing shall be placed at an angle not more than 60 degrees (1.06 rad) or less than 45 degrees (0.79 rad) from the horizontal.
2. Wood boards of $\frac{5}{8}$ inch (15.9 mm) net minimum thickness applied diagonally on studs spaced a maximum of 24 inches (610 mm). Diagonal boards shall be attached to studs in accordance with 780 CMR Table 5602.3(1).
3. Wood structural panel sheathing with a thickness not less than $\frac{5}{16}$ inch (7.9 mm) for 16-inch (406 mm) stud spacing and not less than $\frac{3}{8}$ inch (9.5 mm) for 24-inch (610 mm) stud spacing. Wood structural panels shall be installed in accordance with 780 CMR Table 5602.3(3).
4. $\frac{1}{2}$ (12.7 mm) or $\frac{25}{32}$ -inch (19.8 mm) thick structural fiberboard sheathing applied vertically or horizontally on studs spaced a maximum of 16 inches (406 mm) on center. Structural fiberboard sheathing shall be installed in accordance with 780 CMR Table 5602.3(1).
5. Gypsum board with minimum $\frac{1}{2}$ -inch (12.7 mm) thickness placed on studs spaced a maximum of 24 inches (610 mm) on center and fastened at seven inches (178 mm) on center with the size nails specified in 780 CMR Table

5602.3(1) for sheathing and 780 CMR Table 5702.3.5 for interior gypsum board.

6. Particleboard wall sheathing panels installed in accordance with 780 CMR Table 5602.3(4)

7. Portland cement plaster on studs spaced a maximum of 16 inches (406 mm) on center and installed in accordance with 780 CMR 5703.6.

8. Hardboard panel siding when installed in accordance with 780 Table 5703.4.

Exception: Alternate braced wall panels constructed in accordance with 780 CMR 5602.10.6 shall be permitted to replace any of the above methods of braced wall panels.

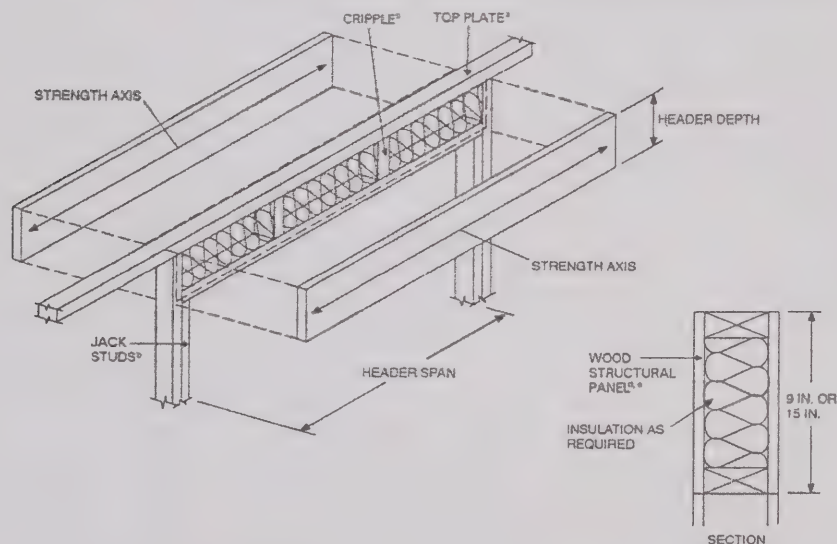
780 CMR TABLE 5602.7.2
MAXIMUM SPANS FOR WOOD STRUCTURAL PANEL BOX HEADERS*

HEADER CONSTRUCTION*	HEADER DEPTH (inches)	HOUSE DEPTH (feet)				
		24	26	28	30	32
Wood structural panel—one side	9	4	4	3	3	—
	15	5	5	4	3	3
Wood structural panel—both sides	9	7	5	5	4	3
	15	8	8	7	7	6

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

- Spans are based on single story with clear-span trussed roof or two-story with floor and roof supported by interior-bearing walls.
- See Figure 5602.7.2 for construction details.

780 CMR FIGURE 5602.7.2
TYPICAL WOOD STRUCTURAL PANEL BOX HEADER CONSTRUCTION



For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

NOTES:

- The top plate shall be continuous over header.
- Jack studs shall be used for spans over four feet.
- Cripple spacing shall be the same as for studs.
- Wood structural panel faces shall be single pieces of $1\frac{1}{32}$ -inch-thick Exposure 1 (exterior glue) or thicker, installed on the interior or exterior or both sides of the header.
- Wood structural panel faces shall be nailed to framing and cripples with 8d common or galvanized box nails spaced three inches on center, staggering alternate nails $\frac{1}{2}$ inch.
- Galvanized nails shall be hot-dipped or tumbled.

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780 CMR TABLE 5602.10.1

WALL BRACING

BASIC WIND SPEED	CONDITION	TYPE OF BRACE ^{a,b}	AMOUNT OF BRACING ^c
100 mph and less	One story Top of two or three story	Methods 1, 2, 3, 4, 5, 6, 7 or 8	Located at each end and at least every 25 feet on center but not less than 16% of braced wall line for Methods 2 through 8.
	First story of two story Second story of three story	Methods 1, 2, 3, 4, 5, 6, 7 or 8	Located at each end and at least every 25 feet on center but not less than 16% of braced wall line for Method 3 and 25% of braced wall line for Methods 2, 4, 5, 6, 7 or 8.
	First story of three story	Methods 2, 3, 4, 5, 6, 7 or 8	Minimum 48-inch-wide panels located at each end and at least every 25 feet on center but not less than 25% of braced wall line for Method 3 and 35% of braced wall line for Methods 2, 4, 5, 6, 7 or 8.
Less than 110 mph	One story Top of two or three story	Methods 1, 2, 3, 4, 5, 6, 7 or 8	Located at each end and at least every 25 feet on center but not less than 16% of braced wall line for Method 3 and 25% of braced wall line for Methods 2, 4, 5, 6, 7 or 8.
	First story of two story Second story of three story	Methods 2, 3, 4, 5, 6, 7 or 8	Located at each end and at least every 25 feet on center but not less than 30% of braced wall line for Method 3 and 45% of braced wall line for Methods 2, 4, 5, 6, 7 or 8.
	First story of three story	Methods 2, 3, 4, 5, 6, 7 or 8	Located at each end and at least every 25 feet on center but not less than 45% of braced wall line for Method 3 and 60% of braced wall line for Methods 2, 4, 5, 6, 7 or 8.
Less than 110 mph	One story Top of two or three story	Methods 2, 3, 4, 5, 6, 7 or 8	Located at each end and at least every 25 feet on center but not less than 20% of braced wall line for Method 3 and 30% of braced wall line for Methods 2, 4, 5, 6, 7 or 8.
	First story of two story Second story of three story	Methods 2, 3, 4, 5, 6, 7 or 8	Located at each end and not more than 25 feet on center but not less than 45% of braced wall line for Method 3 and 60% of braced wall line for Methods 2, 4, 5, 6, 7 or 8.
	First story of three story	Methods 2, 3, 4, 5, 6, 7 or 8	Located at each end and not more than 25 feet on center but not less than 60% of braced wall line for Method 3 and 85% of braced wall line for Methods 2, 4, 5, 6, 7 or 8.
Less than 110 mph	One story Top of two story	Methods 2, 3, 4, 5, 6, 7 or 8	Located at each end and at least every 25 feet on center but not less than 25% of braced wall line for Method 3 and 40% of braced wall line for Methods 2, 4, 5, 6, 7 or 8.
	First story of two story	Methods 2, 3, 4, 5, 6, 7 or 8	Located at each end and not more than 25 feet on center but not less than 55% of braced wall line for Method 3 and 75% of braced wall line for Methods 2, 4, 5, 6, 7 or 8.
	Cripple walls	Method 3	Located at each end and not more than 25 feet on center but not less than 75% of braced wall line.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kN/m², 1 mile per hour = 1.609 km/h.

a. Foundation cripple wall panels shall be braced in accordance with 780 CMR 5602.10.2.

b. Methods of bracing shall be as described in 780 CMR 5602.10.3. The alternate braced wall panels described in 780 CMR 5602.10.6 shall also be permitted.

c. When the dead load of the roof/ceiling exceeds 15psf, the bracing amounts shall be increased in accordance with 780 CMR 5301.2.2.4. Bracing required for a site's wind speed shall not be adjusted.

5602.10.4 Length of Braced Panels. For 780 CMR 5602.10.3 Methods 2., 3., 4., 6., 7. and 8., each braced wall panel shall be at least 48 inches (1219 mm) in length, covering a minimum of three stud spaces where studs are spaced 16 inches (406 mm) on center and covering a minimum of two stud spaces where studs are spaced 24 inches (610 mm) on center. For 780 CMR 5602.10.3 Method 5, each braced wall panel shall be at least 96 inches (2438 mm) in length where applied to one face of a braced wall panel and at least 48 inches (1219 mm) where applied to both faces.

Exceptions:

1. Lengths of braced wall panels for continuous wood structural panel sheathing shall be in accordance with 780 CMR 5602.10.5.
2. Lengths of alternate braced wall panels shall be in accordance with 780 CMR 5602.10.6.

5602.10.5 Continuous Structural Panel Sheathing. When continuous wood structural panel sheathing is provided in accordance with 780 CMR 5602.10.3 Method 3, on all sheathable areas of all exterior walls, and interior braced wall lines, where required, including areas above and below openings, braced wall panel lengths shall be in accordance with 780 CMR Table 5602.10.5. Wood structural panel sheathing shall be installed at corners in accordance with 780 CMR Figure 5602.10.5. The bracing amounts in 780 CMR Table 5602.10.1 for 780 CMR 5602.10.3 Method 3 shall be permitted to be multiplied by a factor of 0.9 for walls with a maximum opening height that does not exceed 85% of the wall height or a factor of 0.8 for walls with a maximum opening height that does not exceed 67% of the wall height.

5602.10.6 Alternate Braced Wall Panels. Alternate braced wall lines constructed in accordance with one of the following provisions shall be permitted to replace each four feet (1219 mm) of braced wall panel as required by 780 CMR 5602.10.4:

1. In one-story buildings, each panel shall have a length of not less than two feet, eight inches (813 mm) and a height of not more than ten feet (3048 mm). Each panel shall be sheathed on one face with $\frac{3}{8}$ -inch minimum-thickness (9.5 mm) wood structural panel sheathing nailed with 8d common or galvanized box nails in accordance with 780 CMR Table 5602.3(1) and blocked at all wood structural panel sheathing edges. Two anchor bolts installed in accordance with 780 CMR Figure 5403.1(1) shall be provided in each panel. Anchor bolts shall be placed at panel quarter points. Each panel end stud shall have a tie-down device fastened to the foundation, capable of providing an uplift capacity of at least 1,800 pounds (816.5 kg). The tie-down device shall be installed in accordance with the manufacturer's recommendations. The panels shall be supported directly on a foundation or on floor framing supported directly on a foundation which is continuous across the entire length of the braced wall line. This foundation shall be reinforced with not less than one No. 4 bar top and bottom. When the continuous foundation is required to have a depth greater than 12 inches (305mm), a minimum 12-inch-by-12-inch (305 mm by 305 mm) continuous footing or turned down slab edge is permitted at door openings in the braced wall line. This continuous footing or turned down slab edge shall be reinforced with not less than one No. 4 bar top and bottom. This reinforcement shall be lapped 15 inches (381 mm) with the reinforcement required in the continuous foundation located directly under the braced wall line.

2. In the first story of two-story buildings, each braced wall panel shall be in accordance with 780 CMR 5602.10.6 Item 1, except that the wood structural panel sheathing shall be provided on both faces, sheathing edge nailing spacing shall not exceed four inches on center, at least three anchor bolts shall be placed at $\frac{1}{5}$ points, and tie-down device uplift capacity shall not be less than 3,000 pounds (1360.8 kg).

780 CMR TABLE 5602.10.5

LENGTH REQUIREMENTS FOR BRACED WALL PANELS IN A CONTINUOUSLY SHEATHED WALL^{a,b}

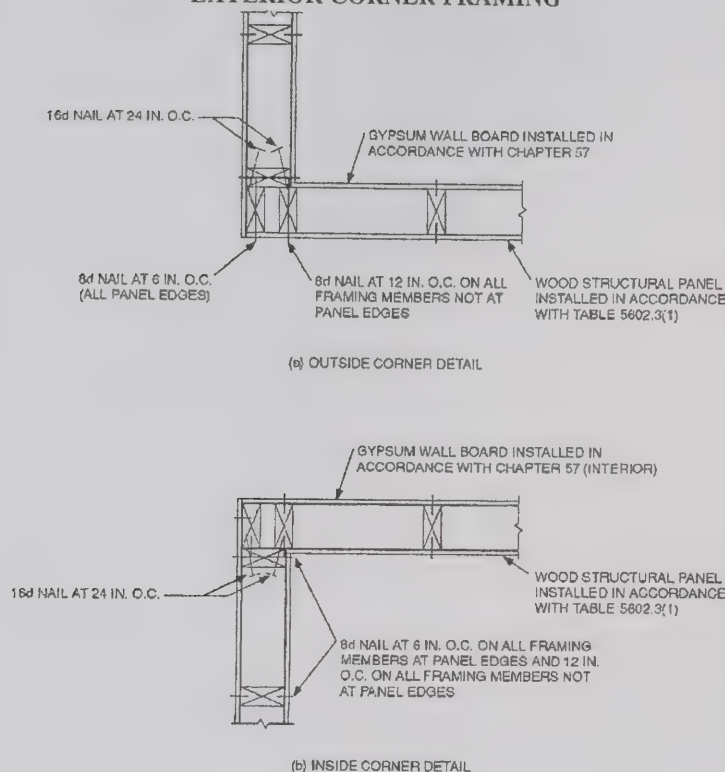
MINIMUM LENGTH OF BRACED WALL PANEL (inches)			MAXIMUM OPENING HEIGHT NEXT TO THE BRACED WALL PANEL (% of wall height)
8-foot wall	9-foot wall	10-foot wall	
48	54	60	100%
32	36	40	85%
24	27	30	65%

For SI: 1 inch = 25.4 mm, 1 foot = 305 mm, 1 pound per square foot = 0.0479 kN/m².

a. Linear interpolation shall be permitted.

b. Full-height sheathed wall segments to either side of garage openings that support light frame roofs only, with roof covering dead loads of 3 psf or less shall be permitted to have a 4:1 aspect ratio.

780 CMR FIGURE 5602.10.5
EXTERIOR CORNER FRAMING



For SI: 1 inch = 25.4 mm.

5602.10.7 Panel Joints. All vertical joints of panel sheathing shall occur over studs. Horizontal joints in braced wall panels shall occur over blocking of a minimum of 1½ inch (38 mm) thickness.

Exception: Blocking is not required behind horizontal joints when constructed in accordance with 780 CMR 5602.10.3 Method 3, braced-wall-panel construction and 780 CMR Table 5602.10.1, Method 3, or where permitted by the manufacturer's installation requirements for the specific sheathing material.

5602.10.8 Connections. Braced wall panel sole plates shall be fastened to the floor framing and top plates shall be connected to the framing above in accordance with 780 CMR Table 5602.3(1). Sills shall be fastened to the foundation or slab in accordance with 780 CMR 5403.1.6. Where joists are perpendicular to the braced wall lines above, blocking shall be provided under and in line with the braced wall panels.

5602.10.9 Design of Structural Elements. Where a building, or portion thereof, does not comply with one or more of the bracing requirements in 780 CMR 5602, those portions shall be designed and constructed in accordance with accepted engineering practice.

780 CMR 5603 STEEL WALL FRAMING

5603.1 General. Elements shall be straight and free of any defects that would significantly affect structural performance. Cold-formed steel wall framing members shall comply with the requirements of 780 CMR 5603.

5603.1.1 Applicability Limits. The provisions of 780 CMR 5603 shall control the construction of exterior steel wall framing and interior load-bearing steel wall framing for buildings not greater than 60 feet (18288 mm) in length perpendicular to the joist or truss span, not greater than 36 feet (10973 mm) in width parallel to the joist span or truss, and not greater than two stories in height with each story not greater than ten feet (3048 mm) high. All exterior walls installed in accordance with the provisions of 780 CMR 5603 shall be considered as load-bearing walls. Steel walls constructed in accordance with the provisions of 780 CMR 5603 shall be limited to sites subjected to a maximum design wind speed of 110 miles per hour Exposure A, B or C and a maximum ground snow load of 70 pounds per foot (3.35 kN/m²).

5603.1.2 In-line Framing. Load-bearing steel studs constructed in accordance with 780 CMR 5603 shall be located directly in-line with joists, trusses and rafters with a maximum tolerance of ¾ inch (19.1 mm) between their center lines.

Interior load-bearing steel stud walls shall be supported on foundations or shall be located directly above load-bearing walls with a maximum tolerance of $\frac{3}{4}$ inch (19.1 mm) between the centerline of the studs.

5603.2 Structural framing. Load-bearing steel wall framing members shall comply with 780 CMR Figure 5603.2(1) and the dimensional and minimum thickness requirements specified in 780 CMR Tables 5603.2(1) and 5603.2(2). Tracks shall comply with 780 CMR Figure 5603.2(2) and shall have a minimum flange width of $1\frac{1}{4}$ inches (32 mm). The maximum inside bend radius for load-bearing members shall be the greater of $\frac{3}{32}$ inch (2.4 mm) or twice the uncoated steel thickness. Holes in wall studs and other structural members shall not exceed 1.5 inches (38 mm) in width or four inches (102 mm) in length as shown in 780 CMR Figure 5603.2(3). Holes shall be permitted only along the centerline of the web of the framing member. Holes shall not be less than 24 inches (610 mm) center to center and shall not be located less than ten inches (254 mm) from edge of hole to end of member unless patched in accordance with 780 CMR 5603.3.5.

5603.2.1 Material. Load-bearing steel framing members shall be cold-formed to shape from structural quality sheet steel complying with the requirements of one of the following:

1. ASTM A 653: Grades 33, 37, 40 and 50

(Classes 1 and 3).

2. ASTM A 792: Grades 33, 37, 40 and 50A.

3. ASTM A 875: Grades 33, 37, 40 and 50 (Classes 1 and 3).

4. Steels that comply with ASTM A 653, except for tensile and elongation, shall be permitted, provided the ratio of tensile strength to yield point is at least 1.08 and the total elongation is at least 10% for a two-inch (51 mm) gage length or 7% for an eight-inch (203 mm) gage length.

5603.2.2 Identification. Load-bearing steel framing members shall have a legible label, stencil, stamp or embossment with the following information as a minimum:

1. Manufacturer's identification.
2. Minimum uncoated steel thickness in inches (mm).
3. Minimum coating designation.
4. Minimum yield strength, in kips per square inch (ksi) (kPa).

5603.2.3 Corrosion Protection. Load-bearing steel framing shall have a metallic coating complying with one of the following:

1. A minimum of G 60 in accordance with ASTM A 653.
2. A minimum of AZ 50 in accordance with ASTM A 792.
3. A minimum of GF 60 in accordance with ASTM A 875.

780 CMR TABLE 5603.2(1)
LOAD-BEARING COLD-FORMED STEEL STUD SIZES

MEMBER DESIGNATION*	WEB DEPTH (inches)	MINIMUM FLANGE WIDTH (inches)	MAXIMUM FLANGE WIDTH (inches)	MINIMUM LIP SIZE (inches)
350S162-t	3.5	1.625	2	0.5
550S162-t	5.5	1.625	2	0.5

For SI: 1 inch = 25.4 mm.

a. The member designation is defined by the first number representing the member depth in $\frac{1}{100}$ inches, the letter "S" representing a stud or joist member, the second number representing the flange width in $\frac{1}{100}$ inches, and the letter "t" shall be a number representing the minimum base metal thickness in mils [See 780CMR Table 5603.2(2)].

780 CMR TABLE 5603.2(2)
MINIMUM THICKNESS OF COLD-FORMED STEEL STUDS

DESIGNATION (mils)	MINIMUM UNCOATED THICKNESS (inches)	REFERENCE GAGE NUMBER
33	0.033	20
43	0.043	18
54	0.054	16
68	0.068	14

For SI: 1 inch = 25.4 mm, 1 mil = 0.0254 mm.

5603.2.4 Fastening Requirements. Screws for steel- to-steel connections shall be installed with a minimum edge distance and center-to-center spacing of $\frac{1}{2}$ inch (12.7 mm), shall be self-drilling tapping and shall conform to SAE J 78. Structural sheathing shall be attached to steel studs with minimum No. 8 self-drilling tapping screws that conform to SAE J 78. Screws for attaching

structural sheathing to steel wall framing shall have a minimum head diameter of 0.292 inch (7.4 mm) with countersunk heads and shall be installed with a minimum edge distance of $\frac{3}{8}$ inch (9.5 mm). Gypsum board shall be attached to steel wall framing with minimum No. 6 screws conforming to ASTM C 954 and shall be installed in accordance with 780 CMR 5702. For all

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connections, screws shall extend through the steel a minimum of three exposed threads. All self-drilling tapping screws conforming to SAE J 78 shall have a Type II coating in accordance with ASTM B 633.

Where No. 8 screws are specified in a steel to steel connection the required number of screws in the connection is permitted to be reduced in accordance with the reduction factors in 780 CMR Table 5505.2.4, when larger screws are used or when one of the sheets of steel being connected is thicker than 33 mils (0.84 mm). When applying the reduction factor the resulting number of screws shall be rounded up.

**780 CMR TABLE 5603.2.4
SCREW SUBSTITUTION FACTOR**

SCREW SIZE	THINNEST CONNECTED STEEL SHEET (mils)	
	33	43
#8	1	0.67
#10	0.93	0.62
#12	0.86	0.56

For SI: 1 mil = 0.0254 mm.

5603.3 Wall Construction. All exterior steel framed walls and interior load-bearing steel framed walls shall be constructed in accordance with the provisions of 780CMR 5603 and 780 CMR Figure 5603.3.

5603.3.1 Wall to Foundation or Floor Connections. Steel framed walls shall be anchored to foundations or floors in accordance with 780 CMR Table 5603.3.1 and 780 CMR Figure 5603.3.1(1) or 5603.3.1(2).

5603.3.2 Load-bearing Walls. Steel studs shall comply with 780 CMR Tables 5603.3.2(2) through 5603.3.2(7) for steels with minimum yield strength of 33 ksi (227.7 MPa) and 780 CMR Tables 5603.3.2(8) through 5603.3.2(13) for steels with minimum yield strength of 50 ksi (345 MPa). Fastening requirements shall be in accordance with 780 CMR 5603.2.4 and 780 CMR Table 5603.3.2(1). Tracks shall have the same minimum steel thickness as the wall studs. Exterior walls with a minimum of ½-inch (12.7 mm) gypsum board installed in accordance with 780 CMR 5702 on the interior surface and wood structural panels of minimum 7/16-inch-thick (11.1 mm) oriented strand board or 15/32-inch-thick (11.9 mm) plywood installed in accordance with 780 CMR Table 5603.3.2(1) on the outside surface shall be permitted to use the next thinner stud, from 780 CMR Tables 5603.3.2(2) through 5603.3.2(13) but not less than 33 mils (0.84 mm). Interior load-bearing walls with a minimum of ½-inch (12.7 mm) gypsum board installed in accordance with 780 CMR 5702 on both sides of the wall shall be permitted to use the next thinner

stud, from 780 CMR Tables 5603.3.2(2) through 5603.3.2(13) but not less than 33 mils (0.84 mm).

5603.3.3 Stud Bracing. The flanges of steel studs shall be laterally braced in accordance with one of the following:

1. Gypsum board installed with minimum No. 6 screws in accordance with 780 CMR 5702 or structural sheathing installed in accordance with 780 CMR Table 5603.3.2.
2. Horizontal steel strapping installed in accordance with 780 CMR Figure 5603.3 at mid-height for eight-foot (2438 mm) walls, and ⅓ points for nine-foot and ten-foot (2743 mm and 3048 mm) walls. Steel straps shall be at least 1.5 inches in width and 33 mils in thickness (38 mm by 0.836 mm). Straps shall be attached to the flanges of studs with at least one No. 8 screw. In-line blocking shall be installed between studs at the termination of all straps. Straps shall be fastened to the blocking with at least two No. 8 screws.

5603.3.4 Cutting and Notching. Flanges and lips of steel studs and headers shall not be cut or notched.

5603.3.5 Hole Patching. Stud web holes with dimensions conforming to 780 CMR 5603.2 that are closer than ten inches (254 mm) from the edge of the hole to the end of the member shall be patched with a solid steel plate, C-section or track section in accordance with 780CMR Figure 5603.3.5. The patch shall be of a minimum thickness as the stud member and shall extend at least one inch (25.4 mm) beyond all edges of the hole. The patch shall be fastened to the web with No. 8 screws (minimum) spaced not greater than one inch (25.4 mm) center to center along the edges of the patch, with a minimum edge distance of ½ inch (12.7 mm).

5603.3.6 Splicing. Steel studs and other structural members shall not be spliced. Tracks shall be spliced in accordance with 780 CMR Figure 5603.3.6.

5603.4 Corner Framing. Corner studs and the top tracks shall be installed in accordance with 780 CMR Figure 5603.4.

5603.5 Exterior Wall Covering. The method of attachment of exterior wall covering materials to cold-formed steel stud wall framing shall conform to the manufacturer's installation instructions.

5603.6 Headers. Headers shall be installed above wall openings in all exterior walls and interior load-bearing walls in accordance with 780 CMR Figure 5603.6 and 780 CMR Table 5603.6(1), Table 5603.6(2), and Table 5603.6(3), or shall be designed and installed in accordance with the AISI Standard for Cold-formed Steel Framing-Header Design (COFS/Header Design).

5603.6.1 Jack and King Studs. The number of jack and king studs shall comply with 780 CMR Table 5603.6(4). Jack and King studs shall be of the same dimension and thickness as the adjacent wall studs. Headers constructed of C-shape framing members shall be connected to king studs in accordance with 780 CMR Table 5603.6(5). $\frac{1}{2}$ of the total number of screws shall be applied to the header and $\frac{1}{2}$ to the king stud by use of a minimum two-inch by two-inch (51 mm by 51 mm) clip angle or four-inch (102mm) wide steel plate. The clip angle or plate shall extend the depth of the header minus $\frac{1}{2}$ inch (12.7 mm) and shall have a minimum thickness of the header members or the wall studs, whichever is thicker.

5603.7 Structural Sheathing. In areas where the basic wind speed is less than 110 miles per hour (177 km/h), wood structural sheathing panels shall be installed on all exterior walls of buildings in accordance with 780 CMR 5603.7. Wood structural sheathing panels shall consist of minimum $\frac{7}{16}$ -inch (11.1 mm) thick oriented strand board or $\frac{15}{32}$ -inch (11.9 mm) thick plywood and shall be installed on all exterior wall surfaces in accordance with 780 CMR 5603.7.1 and 780 CMR Figure 5603.3. The minimum length of full height sheathing on exterior walls shall be determined in accordance with 780 CMR Table 5603.7, but shall not be less than 20% of the braced wall length in any case. The minimum percentage of full height sheathing in 780 CMR Table 5603.7 shall include only those sheathed wall sections, uninterrupted by openings, which are a minimum of 48 inches (1120 mm) wide. The minimum percentage of full-height structural sheathing shall be multiplied by 1.10 for nine-foot-high (2743 mm) walls and multiplied by 1.20 for ten-foot-high (3048 mm) walls. In addition, structural sheathing shall:

1. Be installed with the long dimension parallel to the stud framing and shall cover the full vertical height of studs, from the bottom of the bottom track to the top of the top track of each story.
2. Be applied to each end (corners) of each of the

exterior walls with a minimum 48-inch-wide (1220 mm) panel.

5603.7.1 Structural Sheathing Fastening. All edges and interior areas of wood, structural sheathing panels shall be fastened to a framing member and tracks in accordance with 780 CMR Table 5603.3.2(1).

5603.7.2 Hold-down Requirements. The percent of structural sheathing, required in 780 CMR Table 5603.7, is permitted to be multiplied by 0.6 where a hold down anchor with a capacity of 4,300 pounds (1952.2 kg) is provided at each end of exterior walls. A single hold-down anchor is permitted to be installed at wall corners.

780 CMR 5604 WOOD STRUCTURAL PANELS

5604.1 Identification and Grade. Wood structural panels shall conform to DOC PS 1 or DOC PS 2. All panels shall be identified by a grade mark or certificate of inspection issued by an approved agency.

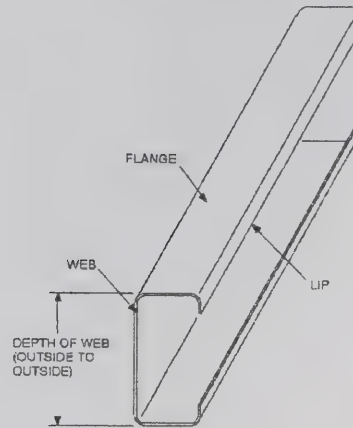
5604.2 Allowable Spans. The maximum allowable spans for wood structural panel wall sheathing shall not exceed the values set forth in 780 CMR Table 5602.3(3).

5604.3 Installation. Wood structural panel wall sheathing shall be attached to framing in accordance with 780 CMR Table 5602.3(1). Wood structural panels marked Exposure 1 or Exterior are considered water-repellent sheathing under the code.

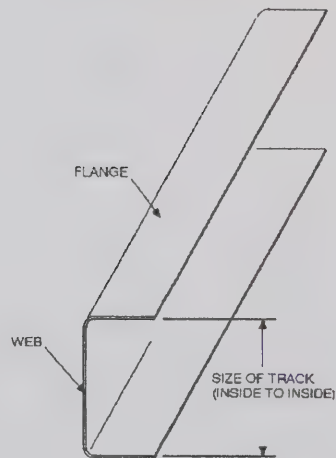
780 CMR 5605 PARTICLEBOARD

5605.1 Identification and Grade. Particleboard shall conform to ANSI A208.1 and shall be so identified by a grade mark or certificate of inspection issued by an approved agency. Particleboard shall comply with the grades specified in 780 CMR Table 5602.3(4).

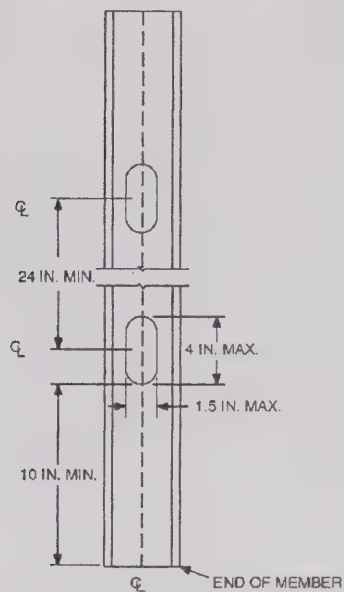
**780 CMR FIGURE 5603.2(1)
C-SECTION**



**780CMR FIGURE 5603.2(2)
TRACK SECTION**

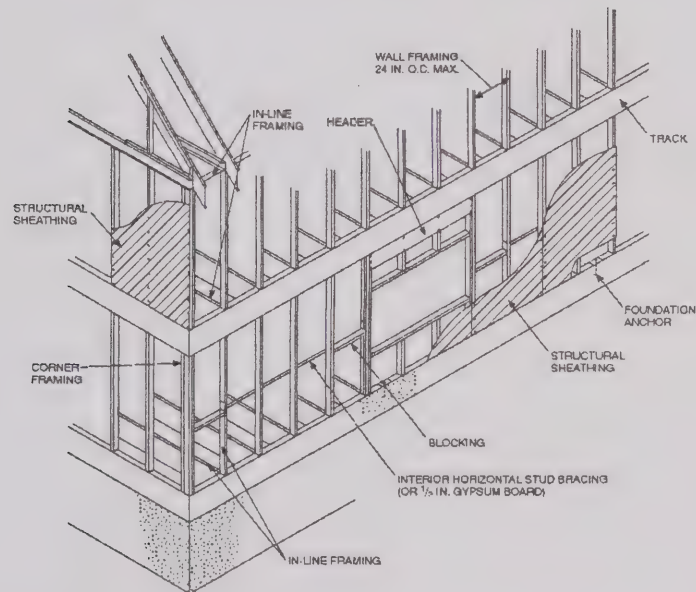


780 CMR FIGURE 5603.2(3)
WEB HOLES



For SI: 1 inch = 25.4 mm.

780 CMR FIGURE 5603.3
STEEL WALL CONSTRUCTION



For SI: 1 inch = 25.4 mm.

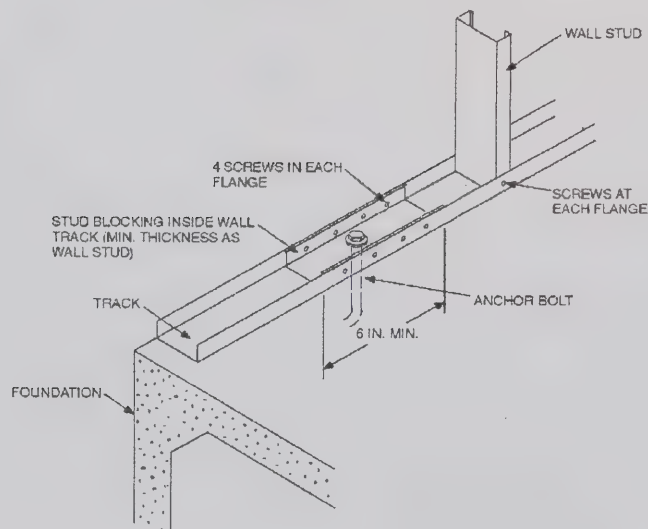
780 CMR TABLE 5603.3.1
WALL TO FOUNDATION OR FLOOR CONNECTION REQUIREMENTS^{a,b,c}

FRAMING CONDITION	BASIC WIND SPEED (mph) AND EXPOSURE		
	85 A/B	85 C or less than 110 A/B	Less than 110 C
Wall bottom track to floor joist or track	1-No. 8 screw at 12" o.c.	1-No. 8 screw at 12" o.c.	2-No. 8 screw at 12" o.c.
Wall bottom track to wood sill per 780 CMR Figure 5603.3.1(2)	Steel plate spaced at 4' o.c., with 4-No. 8 screws and 4-10d or 6-8d common nails	Steel plate spaced at 3' o.c., with 4-No. 8 screws and 4-10d or 6-8d common nails	Steel plate spaced at 2' o.c., with 4-No. 8 screws and 4-10d or 6-8d common nails
Wall bottom track to foundation per 780 CMR Figure 5603.3.1(1)	½" minimum diameter anchor bolt at 6" o.c.	½" minimum diameter anchor bolt at 6" o.c.	½" minimum diameter anchor bolt at 4" o.c.
Wind uplift connector capacity for 16-inch stud spacing ^c	N/R	N/R	65 lbs.
Wind uplift connector capacity for 24-inch stud spacing ^c	N/R	N/R	100 lbs.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 1.609 km/hr, 1 pound = 4.4 N.

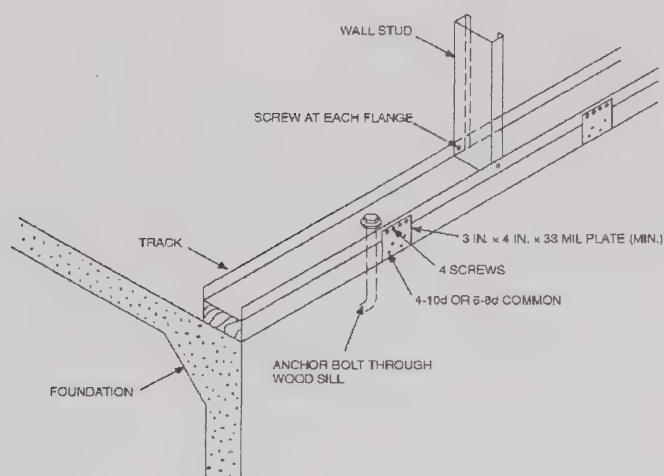
- Anchor bolts shall be located not more than 12 inches from corners or the termination of bottom tracks (e.g., at door openings or corners). Bolts shall extend a minimum of seven inches into concrete or masonry.
- All screw sizes shown are minimum.
- N/R = uplift connector not required. Uplift connectors are in addition to other connection requirements and shall be applied in accordance with 780 CMR 5603.8.

780 CMR FIGURE 5603.3.1(1)
WALL TO FOUNDATION CONNECTION



For SI: 1 inch = 25.4 mm.

780 CMR FIGURE 5603.3.1(2)
WALL TO WOOD SILL CONNECTION



For SI: 1 inch = 25.4 mm, 1 mil = 0.0254 mm.

780 CMR TABLE 5603.3.2(1)
WALL FASTENING SCHEDULE^a

DESCRIPTION OF BUILDING ELEMENT	NUMBER AND SIZE OF FASTENERS ^a	SPACING OF FASTENERS
Floor joist to track of load-bearing wall	2-No. 8 screws	Each joist
Wall stud to top or bottom track	2-No. 8 screws	Each end of stud, one per flange
Structural sheathing to wall studs	No. 8 screw	6" o.c. on edges and 12" o.c. at intermediate supports
Roof framing to wall	Approved design or tie down in accordance with 780 CMR 5802.11	

For SI: 1 inch = 25.4 mm.

a. All screw sizes shown are minimum.

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780 CMR TABLE 5603.3.2(2)

COLD-FORMED STEEL STUD THICKNESS FOR 8-FOOT WALLS

Studs supporting roof and ceiling only (one-story building or second floor of a two-story building) 33 ksi steel

WIND SPEED		MEMBER SIZE ^c	MEMBER SPACING (inches)	STUD THICKNESS (mils) ^{a,b}															
				Building width (feet) ^d															
				24				28				32				36			
				Ground snow load (psf)				Ground snow load (psf)				Ground snow load (psf)				Ground snow load (psf)			
Exp. A/B	Exp. C			20	30	50	70	20	30	50	70	20	30	50	70	20	30	50	70
85 mph	—	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	43
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
100 mph	85 mph	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	33	33	33	33	33	33	33	33	43	33	33	43	43
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
110 mph	100 mph	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	43	43	33	33	43	43	33	43	43	43	43	43	43	43
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
120 mph	110 mph	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	43	43	43	43	43	43	43	54	43	43	54	54	43	43	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
130 mph	120 mph	350S162	16	33	33	43	43	33	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	68	54	54	68	68	54	54	68	68
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	33	33	33	33	43	33	33	33	43	33	33	43	43
—	130 mph	350S162	16	43	43	43	43	43	43	43	43	43	43	43	54	43	43	43	54
			24	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	(d)
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour = 1.609 km/h, 1 pound per square foot = 0.0479 kN/m²,

1 kilogram per square inch = 6.895 MPa.

a. Deflection criteria: 1/240.

b. Building width is in the direction of horizontal framing members supported by the wall studs.

c. Design load assumptions:

Roof dead load is 12 psf.

Attic live load is 10 psf.

d. 68-mil-thick stud is allowed if wall is fully sheathed per 780CMR 5603.3.2.

780 CMR TABLE 5603.3.2(3)

COLD-FORMED STEEL STUD THICKNESS FOR 8-FOOT WALLS

Studs supporting one floor, roof and ceiling (first story of a two-story building) 33 ksi steel

WIND SPEED		MEMBER SIZE ^c	MEMBER SPACING (inches)	STUD THICKNESS (mils) ^{a,b}															
				Building width (feet) ^d															
				24				28				32				36			
Exp. A/B	Exp. C			Ground snow load (psf)				Ground snow load (psf)				Ground snow load (psf)				Ground snow load (psf)			
				20	30	50	70	20	30	50	70	20	30	50	70	20	30	50	70
85 mph	—	350S162	16	33	33	33	33	33	33	33	33	33	33	33	43	33	33	33	43
			24	43	43	43	43	43	43	43	43	43	43	43	54	43	43	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	33	33	33	33	43	33	33	43	43	33	43	43	54
100 mph	85 mph	350S162	16	33	33	33	33	33	33	33	33	33	33	33	43	33	33	43	43
			24	43	43	43	54	43	43	54	54	54	54	54	54	54	54	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	43
			24	33	33	33	33	33	33	33	43	33	33	43	43	43	43	43	54
110 mph	100 mph	350S162	16	33	33	33	33	33	33	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	68	54	54	68	68
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	33	33	33	43	43	43	43	43	43	43	43	43	54
120 mph	110 mph	350S162	16	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	54
			24	54	54	54	68	54	68	68	68	68	68	68	68	68	68	68	68
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	43	43	43	43	43	43	43	43	43	43	43	43	43	43	54
130 mph	120 mph	350S162	16	43	43	43	54	43	54	54	54	54	54	54	54	54	54	54	54
			24	68	68	68	68	68	68	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	43
			24	43	43	43	43	43	43	43	54	43	43	54	54	54	54	54	54
—	130 mph	350S162	16	54	54	54	54	54	54	54	54	54	54	54	68	54	54	68	68
			24	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)
		550S162	16	33	33	33	33	33	33	33	33	33	33	43	43	43	43	43	43
			24	43	43	54	54	54	54	54	54	54	54	54	54	54	54	54	54

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour = 1.609 km/h, 1 pound per square foot = 0.0479 kN/m²,

1 kilogram per square inch = 6.895 MPa.

a. Deflection criteria: 1/240.

b. Building width is in the direction of horizontal framing members supported by the wall studs.

c. Design load assumptions:

Roof dead load is 12 psf.

Attic live load is 10 psf.

d. 68-mil-thick stud is allowed used if wall is fully sheathed per 780 CMR 5603.3.2.

THE MASSACHUSETTS STATE BUILDING CODE

780 CMR TABLE 5603.3.2(4)

COLD-FORMED STEEL STUD THICKNESS FOR 9-FOOT WALLS

Studs supporting roof and ceiling only (one-story building or second floor of a two-story building) 33 ksi steel

WIND SPEED		MEMBER SIZE ^c	MEMBER SPACING (inches)	STUD THICKNESS (mils) ^{a,b}																	
				Building width (feet) ^d																	
Exp. A/B	Exp. C			24				28				32				36					
				Ground snow load (psf)				Ground snow load (psf)				Ground snow load (psf)				Ground snow load (psf)					
				20	30	50	70	20	30	50	70	20	30	50	70	20	30	50	70		
85 mph	—	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	
			24	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	43	
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
100 mph	85 mph	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	
			24	33	33	43	43	33	33	43	43	33	43	43	43	43	43	43	43	43	
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
110 mph	100 mph	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	
			24	43	43	43	43	43	43	43	43	43	43	43	54	43	43	43	43	54	
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
120 mph	110 mph	350S162	16	33	33	33	33	33	33	33	33	43	33	33	43	43	33	33	43	43	
			24	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	68	
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	43
130 mph	120 mph	350S162	16	43	43	43	43	43	43	43	43	43	43	43	43	54	43	43	43	54	
			24	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	(d)	
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43
—	130 mph	350S162	16	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	
			24	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)	
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	43	43	43	43	43	43	43	43	43	43	43	43	54	43	43	43	43	54

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour = 1.609 km/h, 1 pound per square foot = 0.0479 kN/m²,

1 kilogram per square inch = 6.895 MPa.

a. Deflection criteria: 1/240.

b. Building width is in the direction of horizontal framing members supported by the wall studs.

c. Design load assumptions:

Roof dead load is 12 psf.

Attic live load is 10 psf.

d. 68-mil-thick stud is allowed if wall is fully sheathed per 780 CMR 5603.3.2.

780 CMR TABLE 5603.3.2(5)

COLD-FORMED STEEL STUD THICKNESS FOR 9-FOOT WALLS

Studs supporting one floor, roof and ceiling (first story of a two-story building) 33 ksi steel

WIND SPEED		MEMBER SIZE ^c	MEMBER SPACING (inches)	STUD THICKNESS (mils) ^{a,b}															
				Building width (feet) ^d															
				24				28				32				36			
				Ground snow load (psf)				Ground snow load (psf)				Ground snow load (psf)				Ground snow load (psf)			
Exp. A/B	Exp. C			20	30	50	70	20	30	50	70	20	30	50	70	20	30	50	70
85 mph	—	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	43
			24	43	43	43	43	43	43	43	54	43	43	54	54	54	54	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	33	33	33	33	43	33	33	43	43	33	33	43	43
100 mph	85 mph	350S162	16	33	33	33	33	33	33	33	43	33	43	43	43	43	43	43	43
			24	43	54	54	54	54	54	54	54	54	54	54	54	54	54	68	68
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	33	33	33	33	43	33	33	43	43	43	43	43	43
110 mph	100 mph	350S162	16	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	54	54	54	68	68
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	43	43	43	43	43	43	43	43	43	43	43	43	43	54
120 mph	110 mph	350S162	16	43	43	43	43	43	43	43	54	43	43	54	54	54	54	54	54
			24	68	68	68	68	68	68	68	68	68	68	(d)	68	68	(d)	(d)	(d)
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	43	43	43	43	43	43	43	43	43	43	43	54	43	43	54	54
130 mph	120 mph	350S162	16	54	54	54	54	54	54	54	54	54	54	54	68	54	54	68	68
			24	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)
		550S162	16	33	33	33	33	33	33	33	43	33	33	43	43	33	43	43	43
			24	43	43	54	54	54	54	54	54	54	54	54	54	54	54	54	54
—	130 mph	350S162	16	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68
			24	(d)	(d)	(d)	(d)	(d)	(d)	(d)	—	(d)	(d)	—	—	—	—	—	—
		550S162	16	33	33	43	43	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	68	54	54	68	68

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour = 1.609 km/h, 1 pound per square foot = 0.0479 kN/m²,

1 kilogram per square inch = 6.895 MPa.

- Deflection criteria: 1/240.
- Building width is in the direction of horizontal framing members supported by the wall studs.
- Design load assumptions:
Roof dead load is 12 psf.
Attic live load is 10 psf.
- 68-mil-thick stud is allowed if wall is fully sheathed per 780 CMR 5603.3.2.

THE MASSACHUSETTS STATE BUILDING CODE

780 CMR TABLE 5603.3.2(6)

COLD-FORMED STEEL STUD THICKNESS FOR 10-FOOT WALLS

Studs supporting roof and ceiling only (one-story building or second floor of a two-story building) 33 ksi steel

WIND SPEED		MEMBER SIZE ^c	MEMBER SPACING (inches)	STUD THICKNESS (mils) ^{a,b}															
				Building width (feet) ^d															
				24				28				32				36			
				Ground snow load (psf)				Ground snow load (psf)				Ground snow load (psf)				Ground snow load (psf)			
Exp. A/B	Exp. C			20	30	50	70	20	30	50	70	20	30	50	70	20	30	50	70
85 mph	---	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	43	43	33	33	43	43	33	43	43	43
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
100 mph	85 mph	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	43	43	43	43	43	43	43	54	43	43	43	54	43	43	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
110 mph	100 mph	350S162	16	33	33	33	43	33	33	43	43	33	33	43	43	33	33	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	68
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	43
120 mph	110 mph	350S162	16	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	54
			24	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	43	43	33	33	43	43	33	43	43	43	43	43	43	43
130 mph	120 mph	350S162	16	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	68
			24	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	43	43	43	43	43	43	43	54	43	43	54	54	43	43	54	54
---	130 mph	350S162	16	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68
			24	(d)	(d)	(d)	---	(d)	(d)	---	---	(d)	(d)	---	---	(d)	---	---	---
		550S162	16	33	33	33	43	33	33	43	43	33	33	43	43	33	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	68

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour = 1.609 km/h, 1 pound per square foot = 0.0479 kN/m²,

1 kilogram per square inch = 6.895 MPa.

a. Deflection criteria: 1/240.

b. Building width is in the direction of horizontal framing members supported by the wall studs.

c. Design load assumptions:

Roof dead load is 12 psf.

Attic live load is 10 psf.

d. 68-mil-thick stud is allowed if wall is fully sheathed per 780 CMR 5603.3.2.

780 CMR TABLE 5603.3.2(7)

COLD-FORMED STEEL STUD THICKNESS FOR 10-FOOT WALLS

Studs supporting one floor, roof and ceiling (first story of a two-story building) 33 ksi steel

WIND SPEED		MEMBER SIZE ^c	MEMBER SPACING (inches)	STUD THICKNESS (mils) ^{a,b}																
				Building width (feet) ^d																
Exp. A/B	Exp. C			24				28				32				36				
				Ground snow load (psf)				Ground snow load (psf)				Ground snow load (psf)				Ground snow load (psf)				
				20	30	50	70	20	30	50	70	20	30	50	70	20	30	50	70	
85 mph	—	350S162	16	33	33	33	43	33	33	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	68	54	54	68	68	
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	33	33	33	33	33	43	33	33	43	43	43	43	43	54
100 mph	85 mph	350S162	16	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	54
			24	54	54	68	68	68	68	68	68	68	68	68	68	68	68	68	(d)	
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	43	43	43	43	43	43	43	43	43	43	43	43	43	43	54
110 mph	100 mph	350S162	16	43	43	43	43	43	43	43	54	54	43	54	54	54	54	54	54	54
			24	68	68	68	68	68	68	68	(d)	68	68	(d)	(d)	(d)	(d)	(d)	(d)	
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	43	43	43	43	43	43	43	43	43	43	43	54	43	43	54	54	54
120 mph	110 mph	350S162	16	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54
			24	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)	
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	43	43
			24	43	43	43	54	43	54	54	54	54	54	54	54	54	54	54	54	54
130 mph	120 mph	350S162	16	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	(d)
			24	(d)	(d)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		550S162	16	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	68	54	68	68	68	68	68	68	68
—	130 mph	350S162	16	68	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)
			24	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		550S162	16	43	43	43	43	43	43	43	43	43	43	43	43	54	43	43	54	54
			24	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	(d)

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour = 1.609 km/h, 1 pound per square foot = 0.0479 kN/m²,

1 kilogram per square inch = 6.895 MPa.

a. Deflection criteria: 1/240.

b. Building width is in the direction of horizontal framing members supported by the wall studs.

c. Design load assumptions:

Roof dead load is 12 psf.

Attic live load is 10 psf.

d. 68-mil-thick stud is allowed if wall is fully sheathed per 780 CMR 5603.3.2.

THE MASSACHUSETTS STATE BUILDING CODE

780 CMR TABLE 5603.3.2(8)

COLD-FORMED STEEL STUD THICKNESS FOR 8-FOOT WALLS

Studs supporting roof and ceiling only (one-story building or second floor of a two-story building) 50 ksi steel

WIND SPEED		MEMBER SIZE ^c	MEMBER SPACING (inches)	STUD THICKNESS (mils) ^{a,b}																
				Building width (feet) ^d																
Exp. A/B	Exp. C			24				28				32				36				
				Ground snow load (psf)				Ground snow load (psf)				Ground snow load (psf)				Ground snow load (psf)				
				20	30	50	70	20	30	50	70	20	30	50	70	20	30	50	70	
85 mph	---	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
100 mph	85 mph	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
110 mph	100 mph	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	43
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
120 mph	110 mph	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	43	43	33	33	43	43	33	43	43	43	
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
130 mph	120 mph	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	43	43	43	43	43	43	43	43	43	43	43	54	43	43	43	54	
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
---	130 mph	350S162	16	33	33	33	33	33	33	33	33	43	33	33	43	43	33	33	43	43
			24	43	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour = 1.609 km/h, 1 pound per square foot = 0.0479 kN/m²,

1 kilogram per square inch = 6.895 MPa.

a. Deflection criteria: 1/240.

b. Building width is in the direction of horizontal framing members supported by the wall studs.

c. Design load assumptions:

Roof dead load is 12 psf.

Attic live load is 10 psf.

d. 68-mil-thick stud is allowed if wall is fully sheathed per 780 CMR 5603.3.2.

780 CMR TABLE 5603.3.2(9)

COLD-FORMED STEEL STUD THICKNESS FOR 8-FOOT WALLS

Studs supporting one floor, roof and ceiling (first story of a two-story building) 50 ksi steel

WIND SPEED		MEMBER SIZE ^c	MEMBER SPACING (inches)	STUD THICKNESS (mils) ^{a,b}															
				Building width (feet) ^d															
				24				28				32				36			
Exp. A/B	Exp. C			Ground snow load (psf)				Ground snow load (psf)				Ground snow load (psf)				Ground snow load (psf)			
				20	30	50	70	20	30	50	70	20	30	50	70	20	30	50	70
85 mph	—	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	43
			24	33	33	33	43	33	33	43	43	43	43	43	43	43	43	54	
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	33	33	33	33	33	33	33	43	33	33	43	43	
100 mph	85 mph	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	43
			24	33	43	43	43	43	43	43	43	43	43	43	43	43	43	54	
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	43
			24	33	33	33	33	33	33	33	33	33	33	33	43	33	33	43	43
110 mph	100 mph	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	43
			24	43	43	43	43	43	43	43	43	43	43	54	54	43	54	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	33	33	33	33	33	33	33	43	33	33	43	43	
120 mph	110 mph	350S162	16	33	33	33	33	33	33	33	33	43	33	33	43	33	43	43	43
			24	43	43	43	54	43	54	54	54	54	54	54	54	54	54	54	
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	33	33	33	33	33	33	33	43	33	33	43	43	
130 mph	120 mph	350S162	16	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	68	54	54	68	68	68	68	68	
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	43
			24	33	33	33	43	33	43	43	43	43	43	43	43	43	43	43	43
—	130 mph	350S162	16	43	43	43	43	43	43	43	43	43	43	43	54	43	43	54	54
			24	54	68	68	68	68	68	68	68	68	68	68	68	68	68	68	
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour = 1.609 km/h, 1 pound per square foot = 0.0479 kN/m²,

1 kilogram per square inch = 6.895 MPa.

a. Deflection criteria: 1/240.

b. Building width is in the direction of horizontal framing members supported by the wall studs.

c. Design load assumptions:

Roof dead load is 12 psf.

Attic live load is 10 psf.

d. 68-mil-thick stud is allowed if wall is fully sheathed per 780 CMR 5603.3.2.

THE MASSACHUSETTS STATE BUILDING CODE

780 CMR TABLE 5603.3.2(10)

COLD-FORMED STEEL STUD THICKNESS FOR 9-FOOT WALLS

Studs supporting roof and ceiling only (one-story building or second floor of a two-story building) 50 ksi steel

WIND SPEED		MEMBER SIZE ^c	MEMBER SPACING (inches)	STUD THICKNESS (mils) ^{a,b}																
				Building width (feet) ^d																
Exp. A/B	Exp. C			24				28				32				36				
				Ground snow load (psf)				Ground snow load (psf)				Ground snow load (psf)				Ground snow load (psf)				
				20	30	50	70	20	30	50	70	20	30	50	70	20	30	50	70	
85 mph	—	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
100 mph	85 mph	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
110 mph	100 mph	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	33	33	33	33	43	33	33	33	43	33	33	43	43	
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
120 mph	110 mph	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
130 mph	120 mph	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33	43	33	33	43	43
			24	43	43	54	54	43	54	54	54	54	54	54	54	54	54	54	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
—	130 mph	350S162	16	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	68	54	54	54	54	68	
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	33	33	33	33	33	33	33	43	33	33	43	33	43	43

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour = 1.609 km/h, 1 pound per square foot = 0.0479 kN/m²,

1 kilogram per square inch = 6.895 MPa.

- Deflection criteria: 1/240.
- Building width is in the direction of horizontal framing members supported by the wall studs.
- Design load assumptions:
 - Roof dead load is 12 psf.
 - Attic live load is 10 psf.
- 68-mil-thick stud is allowed if wall is fully sheathed per 780CMR 5603.3.2.

780CMR TABLE 5603.3.2(11)

COLD-FORMED STEEL STUD THICKNESS FOR 9-FOOT WALLS

Studs supporting one floor, roof and ceiling (first story of a two-story building) 50 ksi steel

WIND SPEED		MEMBER SIZE ^c	MEMBER SPACING (inches)	STUD THICKNESS (mils) ^{a,b}																
				Building width (feet) ^d																
				24				28				32				36				
				Ground snow load (psf)				Ground snow load (psf)				Ground snow load (psf)				Ground snow load (psf)				
Exp. A/B	Exp. C			20	30	50	70	20	30	50	70	20	30	50	70	20	30	50	70	
85 mph	—	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	43	43	43	43	43	43	43	43	43	43	43	43
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
100 mph	85 mph	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	43
			24	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	43
110 mph	100 mph	350S162	16	33	33	33	33	33	33	33	33	33	33	33	43	33	33	33	43	43
			24	43	43	43	43	43	43	43	54	43	54	54	54	54	54	54	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	43
120 mph	110 mph	350S162	16	33	33	33	43	33	33	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	68
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
130 mph	120 mph	350S162	16	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	54
			24	54	54	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43
—	130 mph	350S162	16	43	43	43	54	43	43	54	54	54	54	54	54	54	54	54	54	54
			24	68	68	68	68	68	68	68	68	68	68	(d)	(d)	68	(d)	(d)	(d)	
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	54

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour = 1.609 km/h, 1 pound per square foot = 0.0479 kN/m²,

1 kilogram per square inch = 6.895 MPa.

a. Deflection criteria: 1/240.

b. Building width is in the direction of horizontal framing members supported by the wall studs.

c. Design load assumptions:

Roof dead load is 12 psf.

Attic live load is 10 psf.

d. 68-mil-thick stud is allowed if wall is fully sheathed per 780 CMR 5603.3.2.

THE MASSACHUSETTS STATE BUILDING CODE

780CMR TABLE 5603.3.2(12)

COLD-FORMED STEEL STUD THICKNESS FOR 10-FOOT WALLS

Studs supporting roof and ceiling only (one-story building or second floor of a two-story building) 50 ksi steel

WIND SPEED		MEMBER SIZE ^c	MEMBER SPACING (inches)	STUD THICKNESS (mils) ^{a,b}															
				Building width (feet) ^d															
				24				28				32				36			
				Ground snow load (psf)				Ground snow load (psf)				Ground snow load (psf)				Ground snow load (psf)			
Exp. A/B	Exp. C			20	30	50	70	20	30	50	70	20	30	50	70	20	30	50	70
85 mph		350S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	43
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
100 mph	85 mph	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	43	33	33	43	43	33	33	43	43
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
110 mph	100 mph	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
120 mph	110 mph	350S162	16	33	33	33	33	33	33	33	33	33	33	33	43	33	33	33	43
			24	43	43	54	54	43	43	54	54	43	54	54	54	54	54	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
130 mph	120 mph	350S162	16	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	68	54	54	68	68	54	54	68	68	54	68	68	68
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	43	43	33	33	43	43	33	43	43	43
	130 mph	350S162	16	43	43	54	54	43	43	54	54	43	54	54	54	54	54	54	54
			24	68	68	68	68	68	68	(d)	68	68	68	(d)	68	68	(d)	(d)	(d)
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour = 1.609 km/h, 1 pound per square foot = 0.0479 kN/m²,

1 kilogram per square inch = 6.895 MPa.

a. Deflection criteria: 1/240.

b. Building width is in the direction of horizontal framing members supported by the wall studs.

c. Design load assumptions:

Roof dead load is 12 psf.

Attic live load is 10 psf.

d. 68-mil-thick stud is allowed if wall is fully sheathed per 780 CMR 5603.3.2.

780 CMR TABLE 5603.3.2(13)

COLD-FORMED STEEL STUD THICKNESS FOR 10-FOOT WALLS

Studs supporting one floor, roof and ceiling (first story of a two-story building) 50 ksi steel

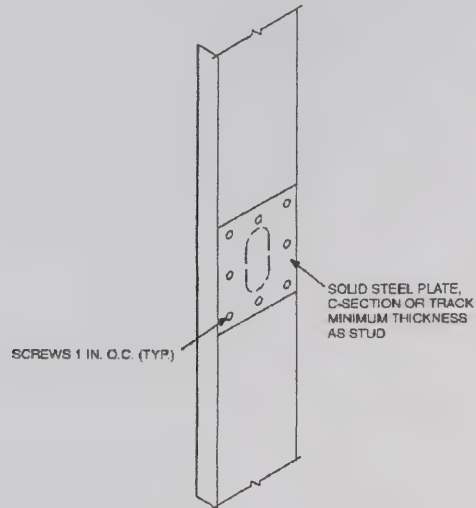
WIND SPEED		MEMBER SIZE ^c	MEMBER SPACING (inches)	STUD THICKNESS (mils) ^{a,b}															
				Building width (feet) ^d															
				24				28				32				36			
				Ground snow load (psf)				Ground snow load (psf)				Ground snow load (psf)				Ground snow load (psf)			
Exp. A/B	Exp. C			20	30	50	70	20	30	50	70	20	30	50	70	20	30	50	70
85 mph	—	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	43
			24	43	43	43	43	43	43	43	43	43	43	54	54	43	54	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	33	33	33	33	33	33	33	33	43	33	33	33	43
100 mph	85 mph	350S162	16	33	33	33	33	33	33	33	43	33	33	43	43	43	43	43	43
			24	43	43	54	54	54	54	54	54	54	54	54	54	54	54	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	33	33	33	33	33	33	33	33	43	33	33	43	43
110 mph	100 mph	350S162	16	33	33	43	43	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	68	68	54	68	68	68
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	33	33	33	33	43	33	43	43	43	43	43	43	43
120 mph	110 mph	350S162	16	43	43	43	43	43	43	43	43	43	43	43	54	43	43	54	54
			24	54	54	68	68	68	68	68	68	68	68	68	68	68	68	(d)	(d)
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43
130 mph	120 mph	350S162	16	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54
			24	68	68	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	43
			24	43	43	43	43	43	43	43	43	43	43	43	54	43	43	54	54
—	130 mph	350S162	16	54	54	54	54	54	54	54	54	54	54	68	68	54	68	68	68
			24	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)
		550S162	16	33	33	33	33	33	33	43	43	33	43	43	43	43	43	43	43
			24	43	43	54	54	54	54	54	54	54	54	54	54	54	54	54	54

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour = 1.609 km/h, 1 pound per square foot = 0.0479 kN/m²,

1 kilogram per square inch = 6.895 MPa.

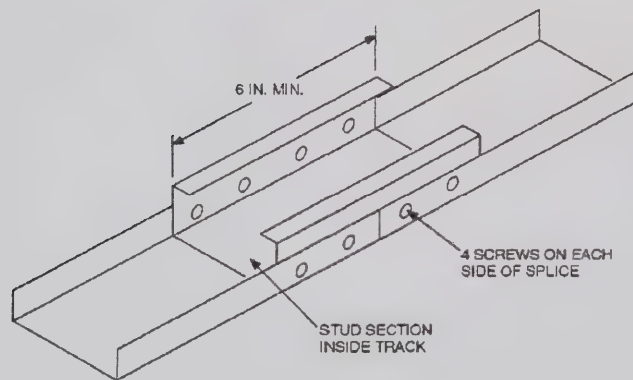
- Deflection criteria: 1/240.
- Building width is in the direction of horizontal framing members supported by the wall studs.
- Design load assumptions:
Roof dead load is 12 psf.
Attic live load is 10 psf.
- 68-mil-thick stud is allowed if wall is fully sheathed per 780CMR 5603.3.2.

**780 CMR FIGURE 5603.3.5
HOLE PATCH**

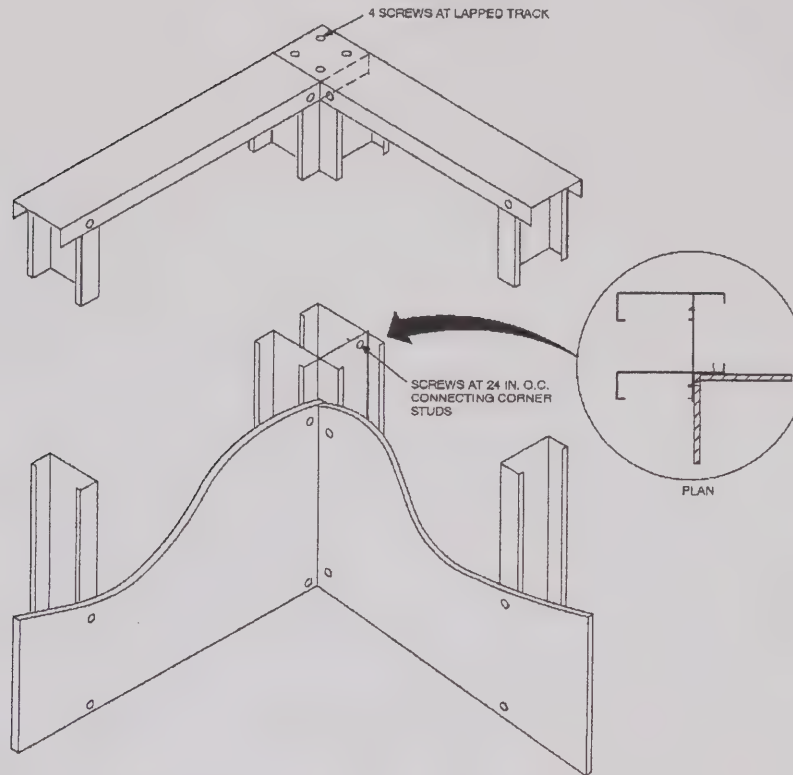


For SI: 1 inch = 25.4 mm.

**780 CMR FIGURE 5603.3.6
TRACK SPLICE**



For SI: 1 inch = 25.4 mm.

**780 CMR FIGURE 5603.4
CORNER FRAMING**

For SI: 1 inch = 25.4mm.

780 CMR TABLE 5603.6(1)
ALLOWABLE HEADER SPANS^{a,b}
Headers supporting roof and ceiling only (33 ksi steel)

NOMINAL MEMBER	GROUND SNOW LOAD (20 psf)				GROUND SNOW LOAD (30 psf)				GROUND SNOW LOAD (50 psf)				GROUND SNOW LOAD (70 psf)			
	Building width ^c (feet)				Building width ^c (feet)				Building width ^c (feet)				Building width ^c (feet)			
	24	28	32	36	24	28	32	36	24	28	32	36	24	28	32	36
2-350S162-33	3'-11"	3'-8"	3'-5"	3'-3"	3'-8"	3'-5"	3'-2"	2'-10"	3'-0"	2'-7"	2'-4"	2'-1"	2'-4"	2'-1"	—	—
2-350S162-43	4'-9"	4'-5"	4'-2"	4'-0"	4'-5"	4'-2"	3'-11"	3'-9"	3'-10"	3'-7"	3'-4"	3'-2"	3'-5"	3'-2"	3'-0"	2'-9"
2-350S162-54	5'-4"	5'-0"	4'-9"	4'-6"	5'-0"	4'-8"	4'-5"	4'-2"	4'-3"	4'-0"	3'-9"	3'-7"	3'-10"	3'-7"	3'-4"	3'-2"
2-350S162-68	6'-0"	5'-7"	5'-3"	5'-0"	5'-7"	5'-3"	4'-11"	4'-8"	4'-10"	4'-6"	4'-3"	4'-0"	4'-3"	4'-0"	3'-9"	3'-7"
2-550S162-33	3'-11"	3'-5"	3'-0"	2'-9"	3'-5"	3'-0"	2'-8"	2'-5"	2'-6"	2'-2"	—	—	—	—	—	—
2-550S162-43	6'-5"	6'-0"	5'-8"	5'-5"	6'-0"	5'-8"	5'-4"	5'-0"	5'-2"	4'-10"	4'-4"	3'-11"	4'-5"	3'-10"	3'-5"	3'-1"
2-550S162-54	7'-3"	6'-10"	6'-5"	6'-1"	6'-9"	6'-4"	6'-0"	5'-8"	5'-10"	5'-5"	5'-1"	4'-10"	5'-2"	4'-10"	4'-7"	4'-4"
2-550S162-68	8'-2"	7'-8"	7'-2"	6'-11"	7'-7"	7'-2"	6'-9"	6'-4"	6'-6"	6'-1"	5'-9"	5'-6"	5'-10"	5'-5"	5'-1"	4'-10"
2-800S162-33	3'-0"	2'-8"	2'-4"	2'-1"	2'-7"	2'-3"	—	—	—	—	—	—	—	—	—	—
2-800S162-43	6'-8"	5'-10"	5'-2"	4'-8"	5'-10"	5'-1"	4'-6"	4'-1"	4'-3"	3'-9"	3'-4"	3'-0"	3'-4"	2'-11"	2'-7"	2'-4"
2-800S162-54	9'-6"	8'-10"	8'-4"	7'-11"	8'-10"	8'-3"	7'-9"	7'-5"	7'-7"	7'-1"	6'-7"	5'-11"	6'-9"	5'-10"	5'-3"	4'-8"
2-800S162-68	10'-8"	10'-0"	9'-5"	8'-11"	9'-11"	9'-4"	8'-9"	8'-4"	8'-6"	8'-0"	7'-6"	7'-2"	7'-7"	7'-1"	6'-8"	6'-4"
2-1000S162-43	5'-7"	4'-10"	4'-4"	3'-11"	4'-10"	4'-3"	3'-9"	3'-5"	3'-7"	3'-1"	2'-9"	2'-6"	2'-10"	2'-6"	2'-2"	—
2-1000S162-54	10'-6"	9'-8"	8'-7"	7'-9"	9'-8"	8'-5"	7'-6"	6'-9"	7'-1"	6'-2"	5'-6"	4'-11"	5'-7"	4'-11"	4'-4"	3'-11"
2-1000S162-68	12'-7"	11'-9"	11'-1"	10'-6"	11'-9"	10'-12"	10'-4"	9'-10"	10'-1"	9'-5"	8'-10"	8'-5"	8'-11"	8'-4"	7'-11"	7'-6"
2-1200S162-43	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2-1200S162-54	9'-6"	8'-3"	7'-4"	6'-7"	8'-3"	7'-3"	6'-5"	5'-9"	6'-1"	5'-4"	4'-9"	4'-3"	4'-10"	4'-2"	3'-9"	3'-4"
2-1200S162-68	13'-5"	12'-7"	11'-10"	11'-3"	12'-6"	11'-9"	11'-1"	10'-6"	10'-9"	10'-1"	9'-6"	8'-6"	9'-7"	8'-5"	7'-6"	6'-9"

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kN/m², 1 kilogram per square inch = 6.895 MPa.

a. Deflection criteria: 1/360 for live loads, 1/240 for total loads.

b. Design load assumptions:

Roof dead load is 7 psf.

Ceiling dead load is 5 psf.

Attic live load is 10 psf.

c. Building width is in the direction of horizontal framing members supported by the header.

780 CMR TABLE 5603.6(2)
ALLOWABLE HEADER SPANS^{a,b}
Headers supporting one floor, roof and ceiling (33 ksi steel)

NOMINAL MEMBER	GROUND SNOW LOAD (20 psf)				GROUND SNOW LOAD (30 psf)				GROUND SNOW LOAD (50 psf)				GROUND SNOW LOAD (70 psf)			
	Building widthc (feet)				Building widthc (feet)				Building widthc (feet)				Building widthc (feet)			
	24	28	32	36	24	28	32	36	24	28	32	36	24	28	32	36
2-350S162-42	3'-3"	3'-1"	2'-11"	2'-8"	3'-2"	3'-0"	2'-9"	2'-6"	2'-11"	2'-8"	2'-4"	2'-2"	2'-10"	2'-6"	2'-3"	2'-1"
2-350S162-54	3'-8"	3'-6"	3'-3"	3'-2"	3'-6"	3'-4"	3'-2"	3'-0"	3'-4"	3'-1"	2'-11"	2'-9"	3'-3"	3'-0"	2'-10"	2'-9"
2-350S162-68	4'-2"	3'-11"	3'-8"	3'-6"	4'-0"	3'-9"	3'-6"	3'-4"	3'-8"	3'-6"	3'-3"	3'-1"	3'-7"	3'-5"	3'-2"	3'-1"
2-550S162-43	4'-1"	3'-8"	3'-3"	3'-0"	3'-10"	3'-4"	3'-0"	2'-9"	3'-3"	2'-11"	2'-7"	2'-4"	3'-2"	2'-9"	2'-6"	2'-3"
2-550S162-54	5'-0"	4'-9"	4'-6"	4'-3"	4'-10"	4'-6"	4'-3"	4'-1"	4'-6"	4'-2"	4'-0"	3'-9"	4'-4"	4'-1"	3'-11"	3'-8"
2-550S162-68	5'-7"	5'-4"	5'-0"	4'-9"	5'-5"	5'-1"	4'-10"	4'-7"	5'-0"	4'-9"	4'-6"	4'-3"	4'-11"	4'-7"	4'-4"	4'-2"
2-800S162-43	3'-2"	2'-10"	2'-6"	2'-3"	2'-11"	2'-7"	2'-4"	—	2'-6"	2'-3"	—	—	2'-5"	2'-2"	—	—
2-800S162-54	6'-3"	5'-7"	5'-0"	4'-6"	5'-10"	5'-2"	4'-7"	4'-2"	5'-0"	4'-5"	4'-0"	3'-7"	4'-10"	4'-3"	3'-10"	3'-5"
2-800S162-68	7'-4"	6'-11"	6'-7"	6'-3"	7'-1"	6'-8"	6'-3"	6'-0"	6'-7"	6'-2"	5'-10"	5'-7"	6'-5"	6'-0"	5'-8"	5'-5"
2-1000S162-43	2'-8"	2'-4"	—	—	2'-5"	—	—	—	—	—	—	—	—	—	—	—
2-1000S162-54	5'-3"	4'-8"	4'-2"	3'-9"	4'-10"	4'-3"	3'-10"	3'-6"	4'-2"	3'-8"	3'-4"	3'-0"	4'-0"	3'-6"	3'-2"	2'-10"
2-1000S162-68	8'-8"	8'-2"	7'-9"	7'-4"	8'-4"	7'-10"	7'-5"	7'-0"	7'-9"	7'-3"	6'-8"	6'-0"	7'-7"	7'-1"	6'-5"	5'-9"
2-1000S162-54	4'-6"	4'-0"	3'-7"	3'-3"	4'-2"	3'-8"	3'-3"	3'-0"	3'-7"	3'-2"	2'-10"	2'-7"	3'-5"	3'-0"	2'-9"	2'-5"
2-1000S162-68	9'-1"	8'-0"	7'-2"	6'-6"	8'-4"	7'-5"	6'-8"	6'-0"	7'-3"	6'-5"	5'-9"	5'-2"	6'-11"	6'-1"	5'-6"	4'-11"

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kN/m², 1 kilogram per square inch = 6.895 MPa.

a. Deflection criteria: L/360 for live loads, L/240 for total loads.

b. Design load assumptions:

Roof dead load is 7 psf.

Ceiling dead load is 5 psf.

Attic live load is 10 psf.

Second floor live load is 30 psf.

Second floor dead load is 10 psf.

Second floor wall dead load is 10 psf.

c. Building width is in the direction of horizontal framing members supported by the header.

780 CMR TABLE 5603.6(3)
ALLOWABLE HEADER SPANS^{a,b,c}

Headers supporting one floor, roof and ceiling first story of a two-story building with center load bearing beam (33 ksi steel)

NOMINAL MEMBER	GROUND SNOW LOAD (20 psf)				GROUND SNOW LOAD (30 psf)				GROUND SNOW LOAD (50 psf)				GROUND SNOW LOAD (70 psf)			
	Building width ^c (feet)				Building width ^c (feet)				Building width ^c (feet)				Building width ^c (feet)			
	24	28	32	36	24	28	32	36	24	28	32	36	24	28	32	36
2-350S162-33	2'-10"	2'-6"	2'-3"	—	2'-7"	2'-3"	—	—	2'-2"	—	—	—	—	—	—	—
2-350S162-43	3'-9"	3'-6"	3'-4"	3'-2"	3'-7"	3'-4"	3'-2"	3'-0"	3'-3"	3'-1"	2'-11"	2'-8"	3'-0"	2'-9"	2'-6"	2'-3"
2-350S162-54	4'-2"	4'-0"	3'-9"	3'-7"	4'-0"	3'-9"	3'-7"	3'-5"	3'-8"	3'-5"	3'-3"	3'-1"	3'-5"	3'-2"	3'-0"	2'-10"
2-350S162-68	4'-8"	4'-5"	4'-2"	4'-0"	4'-6"	4'-2"	4'-0"	3'-10"	4'-1"	3'-10"	3'-8"	3'-6"	3'-9"	3'-7"	3'-4"	3'-2"
2-550S162-33	2'-5"	2'-2"	—	—	2'-2"	—	—	—	—	—	—	—	—	—	—	—
2-550S162-43	5'-1"	4'-9"	4'-3"	3'-10"	4'-10"	4'-3"	3'-10"	3'-6"	4'-0"	3'-7"	3'-2"	2'-11"	3'-5"	3'-1"	2'-9"	2'-6"
2-550S162-54	5'-8"	5'-4"	5'-1"	4'-10"	5'-5"	5'-1"	4'-10"	4'-7"	4'-11"	4'-8"	4'-5"	4'-2"	4'-7"	4'-4"	4'-1"	3'-11"
2-550S162-68	6'-5"	6'-0"	5'-9"	5'-6"	6'-1"	5'-9"	5'-5"	5'-2"	5'-7"	5'-3"	4'-11"	4'-9"	5'-2"	4'-10"	4'-7"	4'-4"
2-800S162-33	4'-2"	3'-8"	3'-3"	3'-0"	3'-8"	3'-3"	2'-11"	2'-8"	3'-1"	2'-9"	2'-5"	2'-3"	2'-8"	2'-4"	—	—
2-800S162-43	7'-5"	7'-0"	6'-6"	6'-0"	7'-1"	6'-6"	5'-10"	5'-4"	6'-2"	5'-5"	4'-11"	4'-5"	5'-3"	4'-8"	4'-2"	3'-9"
2-800S162-54	8'-4"	7'-11"	7'-6"	7'-1"	7'-11"	7'-6"	7'-1"	6'-9"	7'-3"	6'-10"	6'-6"	6'-2"	6'-9"	6'-4"	6'-0"	5'-8"
2-800S162-68	10'-0"	9'-9"	9'-0"	8'-6"	9'-6"	9'-0"	8'-6"	8'-1"	8'-8"	8'-2"	7'-9"	7'-5"	8'-1"	7'-7"	7'-2"	6'-10"
2-1000S162-43	3'-5"	3'-0"	2'-9"	2'-6"	3'-1"	2'-9"	2'-6"	2'-3"	2'-7"	2'-3"	2'-1"	—	2'-3"	—	—	—
2-1000S162-54	6'-10"	6'-0"	5'-6"	5'-0"	6'-2"	5'-5"	4'-11"	4'-5"	5'-1"	4'-6"	4'-1"	3'-8"	4'-5"	3'-11"	3'-6"	3'-2"
2-1000S162-68	9'-10"	9'-4"	8'-10"	8'-5"	9'-4"	8'-10"	8'-4"	8'-0"	8'-7"	8'-1"	7'-8"	7'-3"	7'-0"	7'-6"	7'-0"	6'-4"
2-1200S162-43	2'-11"	2'-7"	2'-4"	2'-1"	2'-8"	2'-4"	—	—	2'-3"	—	—	—	—	—	—	—
2-1200S162-54	5'-10"	5'-2"	4'-8"	4'-3"	5'-3"	4'-8"	4'-2"	3'-10"	4'-5"	3'-11"	3'-6"	3'-2"	3'-9"	3'-4"	3'-0"	2'-8"
2-1200S162-68	10'-6"	10'-0"	9'-5"	8'-6"	9'-12"	9'-5"	8'-5"	7'-8"	8'-10"	7'-10"	7'-0"	6'-4"	7'-7"	6'-9"	6'-0"	5'-5"

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kN/m², 1 kilogram per square inch = 6.895 MPa.

a. Deflection criteria: 1/360 for live loads, 1/240 for total loads.

b. Design load assumptions:

Roof dead load is 7 psf.

Ceiling dead load is 5 psf.

Attic live load is 10 psf.

Second floor live load is 30 psf.

Second floor dead load is 10 psf.

Second floor wall dead load is 10 psf.

c. Building width is in the direction of horizontal framing members supported by the header.

780 CMR TABLE 5603.6(4)

TOTAL NUMBER OF JACK AND KING STUDS REQUIRED AT EACH END OF AN OPENING

SIZE OF OPENING (feet-inches)	24 O.C. STUD SPACING		16 O.C. STUD SPACING	
	No. of jack studs	No. of king studs	No. of jack studs	No. of king studs
Up to 3'-6"	1	1	1	1
> 3'-6" to 5'-0"	1	2	1	2
> 5'-0" to 5'-6"	1	2	2	2
> 5'-6" to 8'-0"	1	2	2	2
> 8'-0" to 10'-6"	2	2	2	3
> 10'-6" to 12'-0"	2	2	3	3
> 12'-0" to 13'-0"	2	3	3	3
> 13'-0" to 14'-0"	2	3	3	4

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

780CMR TABLE 5603.6(5)

HEADER TO KING STUD CONNECTION REQUIREMENTS^{a,b,c,d}

HEADER SPAN (feet)	BASIC WIND SPEED (mph), EXPOSURE		
	85 A/B	85 C or less than 110 A/B	Less than 110 C
≤ 4'	4-No. 8 screws	4-No. 8 screws	6-No. 8 screws
> 4' to 8'	4-No. 8 screws	4-No. 8 screws	8-No. 8 screws
> 8' to 12'	4-No. 8 screws	6-No. 8 screws	10-No. 8 screws
> 12' to 16'	4-No. 8 screws	8-No. 8 screws	12-No. 8 screws

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 1.609 km/h, 1 pound = 0.454 kg.

- All screw sizes shown are minimum.
- For headers located on the first floor of a two-story building, the total number of screws may be reduced by two screws, but the total number of screws shall be no less than four.
- For roof slopes of 6:12 or greater, the required number of screws may be reduced by half, but the total number of screws shall be no less than four.
- Screws can be replaced by a up-lift connector which has a capacity of the number of screws multiplied by 164 pounds (e.g., 12-No. 8 screws can be replaced by an up-lift connector whose capacity exceeds 12 by 164 pounds = 1,968 pounds)

780 CMR TABLE 5603.7

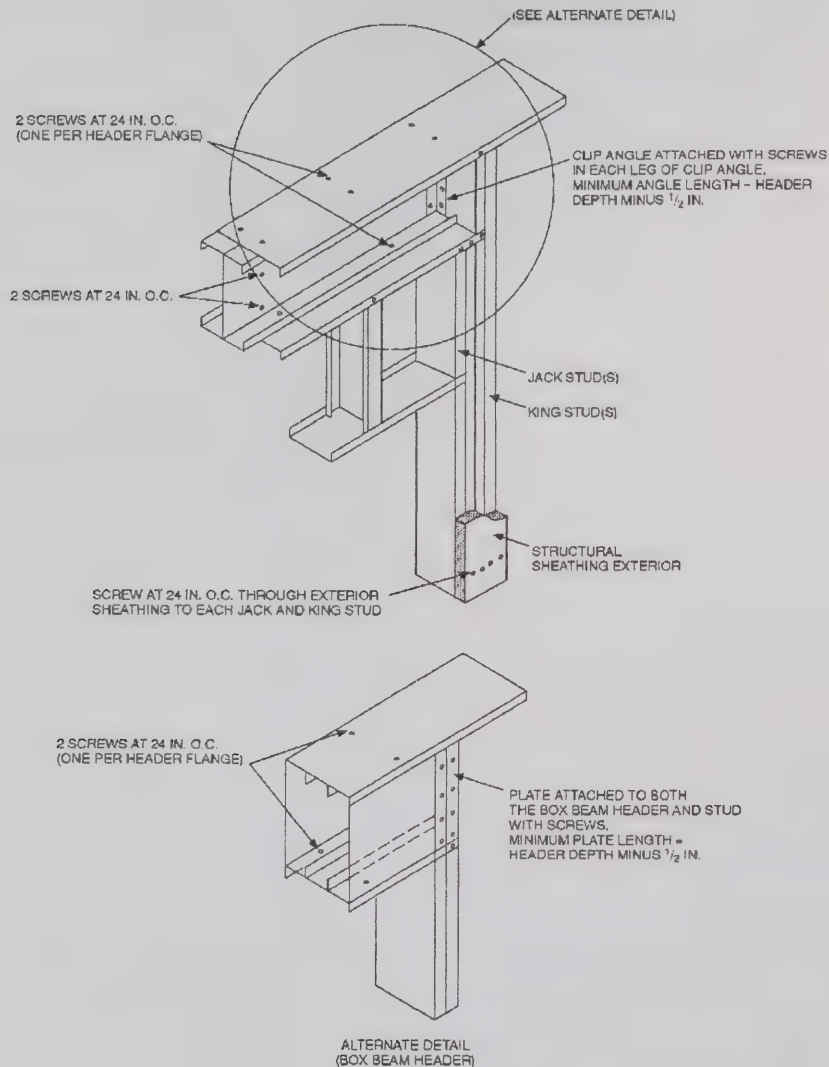
MINIMUM PERCENTAGE OF FULL HEIGHT STRUCTURAL SHEATHING ON EXTERIOR WALLS^{a,b,c,d,e}

WALL SUPPORTING	ROOF SLOPE	WIND SPEED (mph) AND EXPOSURE				
		85 A/B	100 A/B	110 A/B or 85 C	100 C	110 C
Roof and ceiling only	3:12	8	9	12	16	20
	6:12	12	15	20	26	35
	9:12	21	25	30	50	58
	12:12	30	35	40	66	75
One story, roof and ceiling	3:12	24	30	35	50	66
	6:12	25	30	40	58	74
	9:12	35	40	55	74	91
	12:12	40	50	65	100	115

For SI: 1 mile per hour = 1.609 km/h.

- Linear interpolation shall be permitted.
- Bracing amount shall not be less than 20% of the wall length after all applicable adjustments are made.
- Minimum percentages are based on a building aspect ratio of 1:1. Minimum percentages for the shorter walls of a building shall be multiplied by a factor of 1.5 and 2.0 for building aspect ratios of 1.5:1 and 2:1 respectively.
- For hip roofed homes with continuous structural sheathing, the amount of bracing shall be permitted to be multiplied by a factor of 0.95 for roof slopes not exceeding 7:12 and a factor of 0.9 for roof slopes greater than 7:12.
- Sheathing percentage are permitted to be reduced in accordance with 780 CMR 5603.7.2.

780 CMR FIGURE 5603.6
HEADER DETAIL



For SI: 1 inch = 25.4 mm.

780 CMR 5606 GENERAL MASONRY CONSTRUCTION

5606.1 General. Masonry construction shall be designed and constructed in accordance with the provisions of 780 CMR 5606 or in accordance with the provisions of ACI 530/ASCE 5/TMS 402.

5606.1.1 Professional Registration not Required.

Unless the empirical design provisions of ACI 530/ASCE 5/TMS 402 Chapter 5 or the provisions of 780 CMR 5606 are used to design masonry, project drawings, typical details and specifications *shall* bear the seal of the architect or *registered professional* engineer responsible for design.

5606.2 Thickness of Masonry. The nominal thickness of masonry walls shall conform to the requirements of 780 CMR 5606.2.1 through 5606.2.4.

5606.2.1 Minimum Thickness. The minimum thickness of masonry bearing walls more than one story high shall be eight inches (203 mm). Solid masonry walls of one-story dwellings and garages shall not be less than six inches (152 mm) in thickness when not greater than nine feet (2743 mm) in height, provided that when gable construction is used, an additional six feet (1829 mm) is permitted to the peak of the gable. Masonry walls shall be laterally supported in either the horizontal or vertical direction at intervals as required by 780 CMR 5606.8.

5606.2.2 Rubble Stone Masonry Wall. The minimum thickness of rough, random or coursed rubble stone masonry walls shall be 16 inches (406 mm).

5606.2.3 Change in Thickness. Where walls of masonry of hollow units or masonry bonded

hollow walls are decreased in thickness, a course of solid masonry shall be constructed between the wall below and the thinner wall above, or special units or construction shall be used to transmit the loads from face shells or wythes above to those below.

5606.2.4 Parapet Walls. Unreinforced solid masonry parapet walls shall not be less than eight inches (203 mm) in thickness and their height shall not exceed four times their thickness. Unreinforced hollow unit masonry parapet walls shall be not less than eight inches (203 mm) in thickness, and their height shall not exceed three times their thickness.

5606.3 Corbeled Masonry. Solid masonry units shall be used for corbeling. The maximum corbeled projection beyond the face of the wall shall not be more than $\frac{1}{2}$ of the wall thickness or $\frac{1}{2}$ the wythe thickness for hollow walls; the maximum projection of one unit shall not exceed $\frac{1}{2}$ the height of the unit or $\frac{1}{3}$ the thickness at right angles to the wall. The top course of corbels shall be a header course when the corbeled masonry is used to support floor or roof-framing members.

5606.3.1 Support Conditions. Cavity wall or masonry veneer construction may be supported on an eight-inch (203 mm) foundation wall, provided the eight-inch (203 mm) wall is corbeled with solid masonry to the width of the wall system above. The total horizontal projection of the corbel shall not exceed two inches (51 mm) with individual corbels projecting not more than $\frac{1}{3}$ the thickness of the unit or $\frac{1}{2}$ the height of the unit. The top course of all corbels shall be a header course.

5606.4 Allowable Stresses. Allowable compressive stresses in masonry shall not exceed the values prescribed in 780 CMR Table 5606.4. In determining the stresses in masonry, the effects of all loads and conditions of loading and the influence of all forces affecting the design and strength of the several parts shall be taken into account.

**780 CMR TABLE 5606.4
ALLOWABLE COMPRESSIVE STRESSES FOR
EMPIRICAL DESIGN OF MASONRY**

CONSTRUCTION; COMPRESSIVE STRENGTH OF UNIT, GROSS AREA	ALLOWABLE COMPRESSIVE STRESSES ^a GROSS CROSS- SECTIONAL AREA ^b	
	Type M or S mortar	Type N mortar
Solid masonry of brick and other solid units of clay or shale; sand-lime or concrete brick:		
8,000 + psi	350	300
4,500 psi	225	200
2,500 psi	160	140
1,500 psi	115	100
Grouted ^c masonry, of clay or shale; sand-lime or concrete:		
4,500+ psi	225	200
2,500 psi	160	140
1,500 psi	115	100
Solid masonry of solid concrete masonry units:		
3,000+ psi	225	200
2,000 psi	160	140
1,200 psi	115	100
Masonry of hollow load-bearing units:		
2,000+ psi	140	120
1,500 psi	115	100
1,000 psi	75	70
700 psi	60	55
Hollow walls (cavity or masonry bonded ^d) solid units:		
2,500+ psi	160	140
1,500 psi	115	100
Hollow units	75	70
Stone ashlar masonry:		
Granite	720	640
Limestone or marble	450	400
Sandstone or cast stone	360	320
Rubble stone masonry:		
Coarse, rough or random	120	100

For SI: 1 pound per square inch = 6.895 kPa.

- Linear interpolation shall be used for determining allowable stresses for masonry units having compressive strengths that are intermediate between those given in the table.
- Gross cross-sectional area shall be calculated on the actual rather than nominal dimensions.
- See 780 CMR 5607.
- Where floor and roof loads are carried upon one wythe, the gross cross-sectional area is that of the wythe under load; if both wythes are loaded, the gross cross-sectional area is that of the wall minus the area of the cavity between the wythes. Walls bonded with metal ties shall be considered as cavity walls unless the collar joints are filled with mortar or grout.

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5606.4.1 Combined Units. In walls or other structural members composed of different kinds or grades of units, materials or mortars, the maximum stress shall not exceed the allowable stress for the weakest of the combination of units, materials and mortars of which the member is composed. The net thickness of any facing unit that is used to resist stress shall not be less than 1.5 inches (38 mm).

5606.5 Piers. The unsupported height of masonry piers shall not exceed ten times their least dimension. When structural clay tile or hollow concrete masonry units are used for isolated piers to support beams and girders, the cellular spaces shall be filled solidly with concrete or Type M or S mortar, except that unfilled hollow piers may be used if their unsupported height is not more than four times their least dimension. Where hollow masonry units are solidly filled with concrete or Type M, S or N mortar, the allowable compressive stress shall be permitted to be increased as provided in 780 CMR Table 5606.4.

5606.5.1 Pier Cap. Hollow piers shall be capped with four inches (102 mm) of solid masonry or concrete or shall have cavities of the top course filled with concrete or grout or other approved methods.

5606.6 Chases. Chases and recesses in masonry walls shall not be deeper than $\frac{1}{3}$ the wall thickness, and the maximum length of a horizontal chase or horizontal projection shall not exceed four feet (1219 mm), and shall have at least eight inches (203 mm) of masonry in back of the chases and recesses and between adjacent chases or recesses and the jambs of openings. Chases and recesses in masonry walls shall be designed and constructed so as not to reduce the required strength or required fire resistance of the wall and in no case shall a chase or recess be permitted within the required area of a pier. Masonry directly above chases or recesses wider than 12 inches (305 mm) shall be supported on noncombustible lintels.

5606.7 Stack Bond. In unreinforced masonry where masonry units are laid in stack bond, longitudinal reinforcement consisting of not less than two continuous wires each with a minimum aggregate cross-sectional area of 0.017 square inch (11 mm²) shall be provided in horizontal bed joints spaced not more than 16 inches (406 mm) on center vertically.

5606.8 Lateral Support. Masonry walls shall be laterally supported in either the horizontal or the vertical direction. The maximum spacing between lateral supports shall not exceed the distances in 780 CMR Table 5606.8. Lateral support shall be provided by cross walls, pilasters, buttresses or structural frame members when the limiting distance is taken horizontally, or by floors or roofs when the

limiting distance is taken vertically.

5606.8.1 Horizontal Lateral Support. Lateral support in the horizontal direction provided by intersecting masonry walls shall be provided by one of the methods in 780 CMR 5606.8.1.1 or 780 CMR 5606.8.1.2.

5606.8.1.1 Bonding Pattern. 50% of the units at the intersection shall be laid in an overlapping masonry bonding pattern, with alternate units having a bearing of not less than three inches (76 mm) on the unit below.

5606.8.1.2 Metal Reinforcement. Interior nonload-bearing walls shall be anchored at their intersections, at vertical intervals of not more than 16 inches (406mm) with joint reinforcement of at least nine gage, or $\frac{1}{4}$ inch (6.4 mm) galvanized mesh hardware cloth. Intersecting masonry walls, other than interior nonloadbearing walls, shall be anchored at vertical intervals of not more than eight inches (203 mm) with joint reinforcement of at least nine gage and shall extend at least 30 inches (762mm) in each direction at the intersection. Other metal ties, joint reinforcement or anchors, if used, shall be spaced to provide equivalent area of anchorage to that required by 780 CMR 5606.8.

780 CMR TABLE 5606.8
SPACING OF LATERAL SUPPORT FOR
MASONRY WALLS

CONSTRUCTION	MAXIMUM WALL LENGTH TO THICKNESS OR WALL HEIGHT TO THICKNESS ^{a,b}
Bearing walls:	
Solid or solid grouted	20
All other	18
Nonbearing walls:	
Exterior	18
Interior	36

For SI: 1 foot = 304.8 mm.

- Except for cavity walls and cantilevered walls, the thickness of a wall shall be its nominal thickness measured perpendicular to the face of the wall. For cavity walls, the thickness shall be determined as the sum of the nominal thicknesses of the individual wythes. For cantilever walls, except for parapets, the ratio of height to nominal thickness shall not exceed six for solid masonry, or four for hollow masonry. For parapets, see 780 CMR 5606.2.4.
- An additional unsupported height of six feet is permitted for gable end walls.

5606.8.2 Vertical Lateral Support. Vertical lateral support of masonry walls *shall be provided in accordance with one of the methods in 780 CMR 5606.8.2.1 or 780 CMR 5606.8.2.2.*

5606.8.2.1 Roof Structures. Masonry walls shall be anchored to roof structures with metal strap anchors spaced in accordance with the manufacturer's instructions, $\frac{1}{2}$ -inch (12.7 mm) bolts spaced not more than six feet (1829 mm)

on center, or other approved anchors. Anchors shall be embedded at least 16 inches (406 mm) into the masonry, or be hooked or welded to bond beam reinforcement placed not less than six inches (152 mm) from the top of the wall.

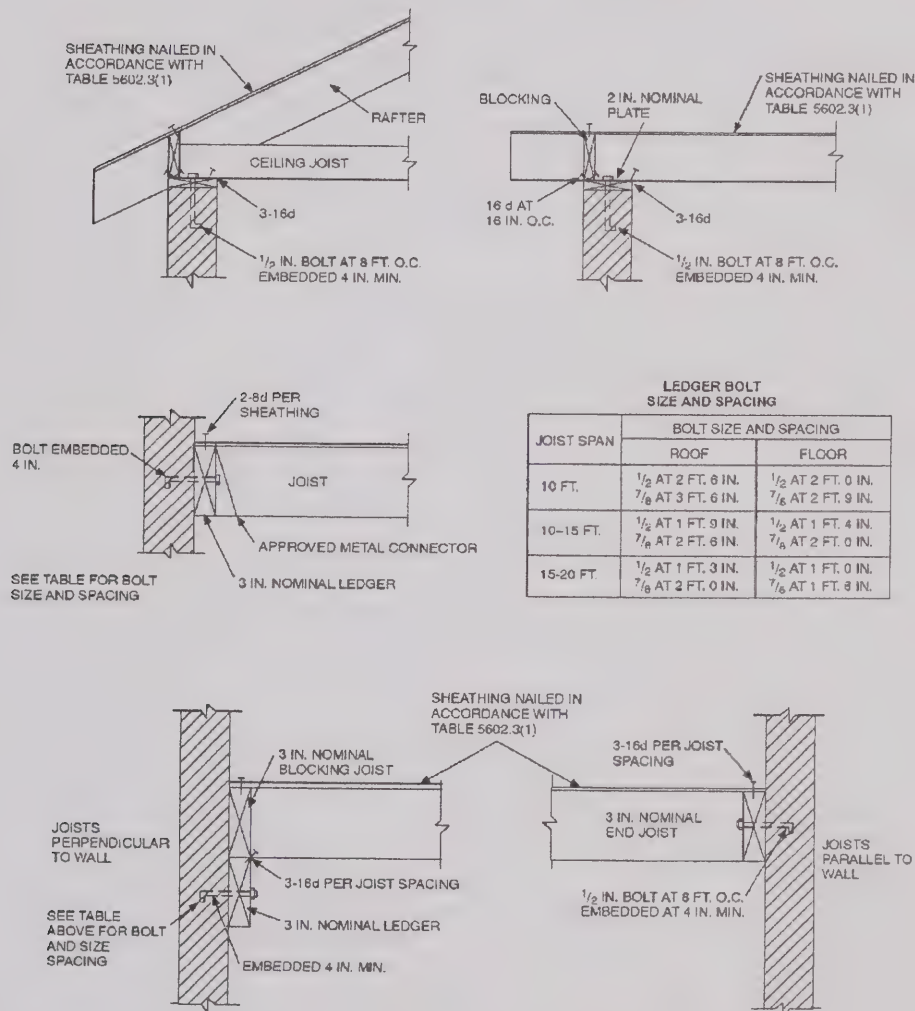
5606.8.2.2 Floor Diaphragms. Masonry walls shall be anchored to floor diaphragm framing by metal strap anchors spaced in accordance with the manufacturer's instructions, 1/2-inch-diameter (12.7 mm) bolts spaced at intervals not to exceed six feet (1829mm) and installed as shown in Figure 5606.10(1), or by other

approved methods.

5606.9 Lintels. Masonry over openings shall be supported by steel lintels, reinforced concrete or masonry lintels or masonry arches, designed to support load imposed.

5606.10 Anchorage. Masonry walls shall be anchored to floor and roof systems in accordance with the details shown in 780 CMR Figure 5606.10(1). Footings may be considered as points of lateral support.

780 CMR FIGURE 5606.10(1)
ANCHORAGE REQUIREMENTS FOR MASONRY WALLS LOCATED WHERE
WIND LOADS ARE LESS THAN 30 PSF



NOTE: Where bolts are located in hollow masonry, the cells in the courses receiving the bolt shall be grouted solid.
For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kN/m².

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5606.11 Protection for Reinforcement. All bars shall be completely embedded in mortar or grout. Joint reinforcement embedded in horizontal mortar joints shall not have less than $\frac{5}{8}$ -inch (15.9 mm) mortar coverage from the exposed face. All other reinforcement shall have a minimum coverage of one bar diameter over all bars, but not less than $\frac{3}{4}$ inch (19.1 mm), except where exposed to weather or soil, in which case the minimum coverage shall be two inches (51 mm).

5606.12 Beam Supports. Beams, girders or other concentrated loads supported by a wall or column shall have a bearing of at least three inches (76 mm) in length measured parallel to the beam upon solid masonry not less than four inches (102 mm) in thickness, or upon a metal bearing plate of adequate design and dimensions to distribute the load safely, or upon a continuous reinforced masonry member projecting not less than four inches (102 mm) from the face of the wall.

5606.12.1 Joist Bearing. Joists shall have a bearing of not less than $1\frac{1}{2}$ inches (38 mm), except as provided in 780CMR 5606.12, and shall be supported in accordance with 780 CMR Figure 5606.10(1).

5606.13 Metal Accessories. Joint reinforcement, anchors, ties and wire fabric shall conform to the following: ASTM A 82 for wire anchors and ties; ASTM A 36 for plate, headed and bent-bar anchors; ASTM A 510 for corrugated sheet metal anchors and ties; ASTM A 951 for joint reinforcement; ASTM B 227 for copper-clad steel wire ties; or ASTM A 167 for stainless steel hardware.

5606.13.1 Corrosion Protection. Minimum corrosion protection of joint reinforcement, anchor ties and wire fabric for use in masonry wall construction shall conform to 780 Table 5606.13.1.

780CMR TABLE 5606.13.1
MINIMUM CORROSION PROTECTION

MASONRY METAL ACCESSORY	STANDARD
Joint reinforcement, interior walls	ASTM A 641, Class 1
Wire ties or anchors in exterior walls completely embedded in mortar or grout	ASTM A 641, Class 3
Wire ties or anchors in exterior walls not completely embedded in mortar or grout	ASTM A 153, Class B-2
Joint reinforcement in exterior walls or interior walls exposed to moist environment	ASTM A 153, Class B-2
Sheet metal ties or anchors exposed to weather	ASTM A 153, Class B-2
Sheet metal ties or anchors completely embedded in mortar or grout	ASTM A 525, Class G-60
Stainless steel hardware for any exposure	ASTM A 167, Type 304

780CMR 5607 UNIT MASONRY

5607.1 Mortar. Mortar for use in masonry construction shall comply with ASTM C 270. The type of mortar shall be in accordance with 780 CMR 5607.1.1, 5607.1.2 and 5607.1.3 and shall meet the proportion specifications of 780CMR Table 5607.1 or the property specifications of ASTM C 270.

5607.1.1 Foundation Walls. Masonry foundation walls constructed as set forth in 780 CMR Tables 5404.1.1(1) through 5404.1.1(4) and mortar shall be Type M or S.

5607.1.2 Masonry Serving as the Lateral-force-resisting System. Mortar for masonry serving as the lateral-force-resisting system shall be Type M, S or N mortar.

5607.2 Placing Mortar and Masonry Units.

5607.2.1 Bed and Head Joints. Unless otherwise required or indicated on the project drawings, head and bed joints shall be $\frac{3}{8}$ inch (9.5 mm) thick, except that the thickness of the bed joint of the starting course placed over foundations shall not be less than $\frac{1}{4}$ inch (6.4mm) and not more than $\frac{3}{4}$ inch (19.1 mm).

5607.2.1.1 Mortar Joint Thickness Tolerance. Mortar joint thickness shall be within the following tolerances from the specified dimensions:

1. Bed joint: $+\frac{1}{8}$ inch (3.2 mm).
2. Head joint: $\frac{1}{4}$ inch (6.4mm), $+\frac{3}{8}$ inch (9.5mm).
3. Collar joints: $\frac{1}{4}$ inch (6.4mm), $+\frac{3}{8}$ inch (9.5mm).

Exception: Nonload-bearing masonry elements and masonry veneers designed and constructed in accordance with 780 CMR 5703.7 are not required to meet these tolerances.

5607.2.2 Masonry Unit Placement. The mortar shall be sufficiently plastic and units shall be placed with sufficient pressure to extrude mortar from the joint and produce a tight joint. Deep furrowing of bed joints that produces voids shall not be permitted. Any units disturbed to the extent that initial bond is broken after initial placement shall be removed and relaid in fresh mortar. Surfaces to be in contact with mortar shall be clean and free of deleterious materials.

5607.2.2.1 Solid Masonry. All solid masonry units shall be laid with full head and bed joints and all interior vertical joints that are designed to receive mortar shall be filled.

5607.2.2.2 Hollow Masonry. For hollow masonry units, all head and bed joints shall be filled solidly with mortar for a distance in from the face of the unit not less than the thickness of the face shell.

5607.3 Installation of Wall Ties. The installation of wall ties shall be as follows:

1. The ends of wall ties shall be embedded in mortar joints. Wall tie ends shall engage outer face shells of hollow units by at least ½ inch

(12.7mm). Wire wall ties shall be embedded at least 1½ inches (38 mm) into the mortar bed of solid masonry units or solid grouted hollow units.

2. Wall ties shall not be bent after being embedded in grout or mortar.

780 TABLE 5607.1

MORTAR PROPORTIONS^{a,b}

PROPORTIONS BY VOLUME (cementitious materials)											
Mortar	Type	Portland cement or blended cement	Mortar cement			Masonry cement			Hydrated lime ^c or lime putty	Aggregate ratio (measured in damp, loose conditions)	
			M	S	N	M	S	N			
Cement-lime	M	1	—	—	—	—	—	—	¼	Not less than 2¼ and not more than 3 times the sum of separate volumes of lime, if used, and cement	
	S	1	—	—	—	—	—	—	over ¼ to ½		
	N	1	—	—	—	—	—	—	over ½ to 1¼		
	O	1	—	—	—	—	—	—	over 1¼ to 2½		
Mortar cement	M	1	—	—	1	—	—	—	—	Not less than 2¼ and not more than 3 times the sum of separate volumes of lime, if used, and cement	
	M	—	1	—	—	—	—	—			
	S	½	—	—	1	—	—	—			
	S	—	—	1	—	—	—	—			
	N	—	—	—	1	—	—	—			
	O	—	—	—	1	—	—	—			
Masonry cement	M	1	—	—	—	—	—	1	—	Not less than 2¼ and not more than 3 times the sum of separate volumes of lime, if used, and cement	
	M	—				1	—	—			
	S	½				—	—	1			
	S	—				—	1	—			
	N	—				—	—	1			
	O	—				—	—	1			

For SI: 1 cubic foot = 0.0283 m³, 1 pound = 0.454 kg.

- a. For the purpose of these specifications, the weight of 1 cubic foot of the respective materials shall be considered to be as follows:

Portland Cement	94 pounds	Masonry Cement	Weight printed on bag
Mortar Cement	Weight printed on bag	Hydrated Lime	40 pounds
Lime Putty (Quicklime)	80 pounds	Sand, damp and loose	80 pounds of dry sand

- b. Two air-entraining materials shall not be combined in mortar.

- c. Hydrated lime conforming to the requirements of ASTM C 207.

780CMR 5608 MULTIPLE WYTHER MASONRY

5608.1 General. The facing and backing of multiple wythe masonry walls shall be bonded in accordance with 780 CMR 5608.1.1, 5608.1.2 or 5608.1.3. In cavity walls, neither the facing nor the backing shall be less than three inches (76 mm) nominal in thickness and the cavity shall not be more than four inches (102 mm) nominal in width. The backing shall be at least as thick as the facing.

Exception: Cavities shall be permitted to exceed the four-inch (102 mm) nominal dimension provided tie size and tie spacing have been established by calculation.

5608.1.1 Bonding with Masonry Headers. Bonding with solid or hollow masonry headers shall comply with 780 CMR 5608.1.1.1 and 5608.1.1.2.

5608.1.1.1 Solid Units. Where the facing and backing (adjacent wythes) of solid masonry construction are bonded by means of masonry headers, no less than 4% of the wall surface of each face shall be composed of headers extending not less than three inches (76 mm) into the backing. The distance between

adjacent full-length headers shall not exceed 24 inches (610 mm) either vertically or horizontally. In walls in which a single header does not extend through the wall, headers from the opposite sides shall overlap at least three inches (76 mm), or headers from opposite sides shall be covered with another header course overlapping the header below at least three inches (76 mm).

5608.1.1.2 Hollow Units. Where two or more hollow units are used to make up the thickness of a wall, the stretcher courses shall be bonded at vertical intervals not exceeding 34 inches (864 mm) by lapping at least three inches (76 mm) over the unit below, or by lapping at vertical intervals not exceeding 17 inches (432 mm) with units that are at least 50% greater in thickness than the units below.

5608.1.2 Bonding with Wall Ties or Joint Reinforcement. Bonding with wall ties or joint reinforcement shall comply with 780 CMR 5608.1.2.1 through 5608.1.2.3.

5608.1.2.1 Bonding with Wall Ties. Bonding with wall ties, except as required by 780 CMR

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5610, where the facing and backing (adjacent wythes) of masonry walls are bonded with $\frac{3}{16}$ -inch-diameter (4.8 mm) wall ties embedded in the horizontal mortar joints, there shall be at least one metal tie for each 4.5 square feet (0.418 m²) of wall area. Ties in alternate courses shall be staggered. The maximum vertical distance between ties shall not exceed 24 inches (610 mm), and the maximum horizontal distance shall not exceed 36 inches (914 mm). Rods or ties bent to rectangular shape shall be used with hollow masonry units laid with the cells vertically. In other walls, the ends of ties shall be bent to 90-degree (0.79 rad) angles to provide hooks no less than 2 inches (51 mm) long. Additional bonding ties shall be provided at all openings, spaced not more than three feet (914 mm) apart around the perimeter and within 12 inches (305 mm) of the opening.

5608.1.2.2 Bonding with Adjustable Wall Ties. Where the facing and backing (adjacent wythes) of masonry are bonded with adjustable wall ties, there shall be at least one tie for each 2.67 square feet (0.248 m²) of wall area. Neither the vertical nor horizontal spacing of the adjustable wall ties shall exceed 24 inches (610 mm). The maximum vertical offset of bed joints from one wythe to the other shall be 1.25 inches (32 mm). The maximum clearance between connecting parts of the ties shall be $\frac{1}{16}$ inch (1.6 mm). When pintle legs are used, ties shall have at least two $\frac{3}{16}$ -inch-diameter (4.8 mm) legs.

5608.1.2.3 Bonding with Prefabricated Joint Reinforcement. Where the facing and backing (adjacent wythes) of masonry are bonded with prefabricated joint reinforcement, there shall be at least one cross wire serving as a tie for each 2.67 square feet (0.248 m²) of wall area. The vertical spacing of the joint reinforcement shall not exceed 16 inches (406 mm). Cross wires on prefabricated joint reinforcement shall not be smaller than No. 9 gage. The longitudinal wires shall be embedded in the mortar.

5608.1.3 Bonding with natural or cast stone. Bonding with natural and cast stone shall conform to 780 CMR 5608.1.3.1 and 5608.1.3.2.

5608.1.3.1 Ashlar Masonry. In ashlar masonry, bonder units, uniformly distributed, shall be provided to the extent of not less than 10% of the wall area. Such bonder units shall extend not less than four inches (102 mm) into the backing wall.

5608.1.3.2 Rubble Stone Masonry. Rubble stone masonry 24 inches (610 mm) or less in thickness shall have bonder units with a maximum spacing of three feet (914 mm) vertically and three feet (914 mm) horizontally,

and if the masonry is of greater thickness than 24 inches (610 mm), shall have one bonder unit for each six square feet (0.557 m²) of wall surface on both sides.

5608.2 Masonry Bonding Pattern. Masonry laid in running and stackbond shall conform to 780 CMR 5608.2.1 and 5608.2.2.

5608.2.1 Masonry Laid in Running Bond. In each wythe of masonry laid in running bond, head joints in successive courses shall be offset by not less than one-fourth the unit length, or the masonry walls shall be reinforced longitudinally as required in 780 CMR 5608.2.2.

5608.2.2 Masonry Laid in Stack Bond. Where unit masonry is laid with less head joint offset than in 780 CMR 5607.2.1, the minimum area of horizontal reinforcement placed in mortar bed joints or in bond beams spaced not more than 48 inches (1219 mm) apart, shall be 0.0007 times the vertical cross-sectional area of the wall.

780 CMR 5609 GROUTED MASONRY

5609.1 General. Grouted multiple-wythe masonry is a form of construction in which the space between the wythes is solidly filled with grout. It is not necessary for the cores of masonry units to be filled with grout. Grouted hollow unit masonry is a form of construction in which certain cells of hollow units are continuously filled with grout.

5609.1.1 Grout. Grout shall consist of cementitious material and aggregate in accordance with ASTM C 476 and the proportion specifications of 780 CMR Table 5609.1.1. Type M or Type S mortar to which sufficient water has been added to produce pouring consistency can be used as grout.

5609.1.2 Grouting Requirements. Maximum pour heights and the minimum dimensions of spaces provided for grout placement shall conform to 780 CMR Table 5609.1.2. If the work is stopped for one hour or longer, the horizontal construction joints shall be formed by stopping all tiers at the same elevation and with the grout one inch (25.4 mm) below the top.

5609.1.3 Grout Space (Cleaning). Provision shall be made for cleaning grout space. Mortar projections that project more than 0.5 inch (12.7 mm) into grout space and any other foreign matter shall be removed from grout space prior to inspection and grouting.

5609.1.4 Grout Placement. Grout shall be a plastic mix suitable for pumping without segregation of the constituents and shall be mixed thoroughly. Grout shall be placed by pumping or by an approved alternate method and shall be placed before any initial set occurs and in no case more than 1½ hours after water has been added. Grouting shall be done in a continuous pour, in

lifts not exceeding five feet (1524 mm). It shall be consolidated by puddling or mechanical vibrating during placing and reconsolidated after excess moisture has been absorbed but before plasticity is lost.

5609.1.4.1 Grout Pumped through Aluminum Pipes. Grout shall not be pumped through aluminum pipes.

5609.1.5 Cleanouts. Where required by the building official, cleanouts shall be provided as specified in 780 CMR 5609. The cleanouts shall be sealed before grouting and after inspection.

5609.1.5.1 Grouted Multiple-wythe Masonry. Cleanouts shall be provided at the bottom course of the exterior wythe at each pour of grout where such pour exceeds five feet (1524 mm) in height.

5609.1.5.2 Grouted Hollow Unit Masonry. Cleanouts shall be provided at the bottom course of each cell to be grouted at each pour of grout, where such pour exceeds four feet

(1219 mm) in height.

5609.2 Grouted Multiple-wythe Masonry. Grouted multiple-wythe masonry shall conform to all the requirements specified in 780 CMR 5609.1 and the requirements of 780CMR 5609.2.

5609.2.1 Bonding of Backup Wythe. Where all interior vertical spaces are filled with grout in multiple-wythe construction, masonry headers shall not be permitted. Metal wall ties shall be used in accordance with 780 CMR 5608.1.2 to prevent spreading of the wythes and to maintain the vertical alignment of the wall. Wall ties shall be installed in accordance with 780 CMR 5608.1.2 when the backup wythe in multiple-wythe construction is fully grouted.

5609.2.2 Grout Spaces. Fine grout shall be used when interior vertical space to receive grout does not exceed two inches (51 mm) in thickness. two Interior vertical spaces exceeding two inches (51 mm) in thickness shall use coarse or fine grout.

780 CMR TABLE 5609.1.1

GROUT PROPORTIONS BY VOLUME FOR MASONRY CONSTRUCTION

TYPE	PORTLAND CEMENT OR BLENDED CEMENT SLAG CEMENT	HYDRATED LIME OR LIME PUTTY	AGGREGATE MEASURED IN A DAMP, LOOSE CONDITION	
			Fine	Coarse
Fine	1	0 to 1/10	2¼ to 3 times the sum of the volume of the cementitious materials	---
Coarse	1	0 to 1/10	2¼ to 3 times the sum of the volume of the cementitious materials	1 to 2 times the sum of the volumes of the cementitious materials

780 CMR TABLE 5609.1.2

GROUT SPACE DIMENSIONS AND POUR HEIGHTS

GROUT TYPE	GROUT POUR MAXIMUM HEIGHT (feet)	MINIMUM WIDTH OF GROUT SPACES ^{a,b} (inches)	MINIMUM GROUT ^{b,c} SPACE DIMENSIONS FOR GROUTING CELLS OF HOLLOW UNITS (inches x inches)
Fine	1	0.75	1.5 x 2
	5	2	2 x 3
	12	2.5	2.5 x 3
	24	3	3 x 3
Coarse	1	1.5	1.5 x 3
	5	2	2.5 x 3
	12	2.5	3 x 3
	24	3	3 x 4

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

a. For grouting between masonry wythes.

b. Grout space dimension is the clear dimension between any masonry protrusion and shall be increased by the horizontal projection of the diameters of the horizontal bars within the cross section of the grout space.

c. Area of vertical reinforcement shall not exceed 6% of the area of the grout space.

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5609.2.3 Grout Barriers. Vertical grout barriers or dams shall be built of solid masonry across the grout space the entire height of the wall to control the flow of the grout horizontally. Grout barriers shall not be more than 25 feet (7620 mm) apart. The grouting of any section of a wall between control barriers shall be completed in one day with no interruptions greater than one hour.

5609.3 Reinforced Grouted Multiple-wythe Masonry. Reinforced grouted multiple-wythe masonry shall conform to all the requirements specified in 780 CMR 5609.1 and 5609.2 and the requirements of 780 CMR 5609.3.

5609.3.1 Construction. The thickness of grout or mortar between masonry units and reinforcement shall not be less than $\frac{1}{4}$ inch (6.4 mm), except that $\frac{1}{4}$ -inch (6.4 mm) bars may be laid in horizontal mortar joints at least $\frac{1}{2}$ inch (12.7 mm) thick, and steel wire reinforcement may be laid in horizontal mortar joints at least twice the thickness of the wire diameter.

5609.4 Reinforced Hollow Unit Masonry. Reinforced hollow unit masonry shall conform to all the requirements of 780 CMR 5609.1 and the requirements of 780 CMR 4609.4.

5609.4.1 Construction. Requirements for construction shall be as follows:

1. All reinforced hollow-unit masonry shall be built to preserve the unobstructed vertical continuity of the cells to be filled. Walls and cross webs forming such cells to be filled shall be full-bedded in mortar to prevent leakage of grout. All head and end joints shall be solidly filled with mortar for a distance in from the face of the wall or unit not less than the thickness of the longitudinal face shells. Bond shall be provided by lapping units in successive vertical courses.
2. Cells to be filled shall have vertical alignment sufficient to maintain a clear, unobstructed continuous vertical cell of dimensions prescribed in 780 CMR Table 5609.1.2.
3. Vertical reinforcement shall be held in position at top and bottom and at intervals not exceeding 200 diameters of the reinforcement.

4. All cells containing reinforcement shall be filled solidly with grout. Grout shall be poured in lifts of eight-foot (2438 mm) maximum height. When total grout pour exceeds eight feet (2438 mm) in height, the grout shall be placed in lifts not exceeding five feet (1524 mm) and special inspection during grouting shall be required.

5. Horizontal steel shall be fully embedded by grout in an uninterrupted pour.

780 CMR 5610 GLASS UNIT MASONRY

5610.1 General. Panels of glass unit masonry located in load-bearing and nonload-bearing exterior and interior walls shall be constructed in accordance with 780CMR 5610.

5610.2 Materials. Hollow glass units shall be partially evacuated and have a minimum average glass face thickness of $\frac{3}{16}$ inch (4.8 mm). The surface of units in contact with mortar shall be treated with a polyvinyl butyral coating or latex-based paint. The use of reclaimed units is prohibited.

5610.3 Units. Hollow or solid glass block units shall be standard or thin units.

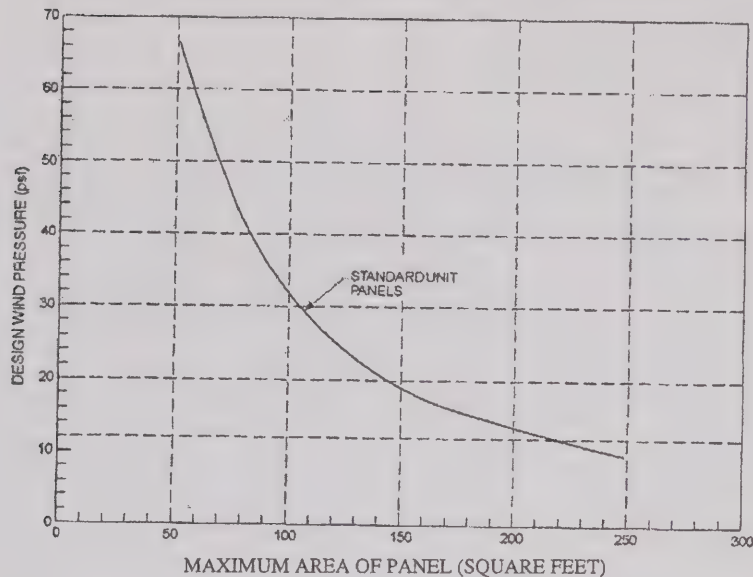
5610.3.1 Standard Units. The specified thickness of standard units shall be at least $3\frac{7}{8}$ inches (98 mm).

5610.3.2 Thin Units. The specified thickness of thin units shall be at least $3\frac{1}{8}$ inches (79 mm) for hollow units and at least three inches (76 mm) for solid units.

5610.4 Isolated Panels. Isolated panels of glass unit masonry shall conform to the requirements of 780 CMR 5610.4.

5610.4.1 Exterior Standard-unit Panels. The maximum area of each individual standard-unit panel shall be 144 square feet (13.4 m²) when the design wind pressure is 20 psf (958 Pa). The maximum area of such panels subjected to design wind pressures other than 20 psf (958 Pa) shall be in accordance with 780 CMR Figure 5610.4.1. The maximum panel dimension between structural supports shall be 25 feet (7620 mm) in width or 20 feet (6096 mm) in height.

780 CMR FIGURE 5410.4.1
GLASS UNIT MASONRY DESIGN WIND LOAD RESISTANCE



For SI: 1 square foot = 0.0929 m², 1 pound per square foot = 0.0479 kN/m².

5610.4.2 Exterior Thin-unit Panels. The maximum area of each individual thin-unit panel shall be 85 square feet (7.9 m²). The maximum dimension between structural supports shall be 15 feet (4572 mm) in width or ten feet (3048 mm) in height. Thin units shall not be used in applications where the design wind pressure as stated in 780 CMR Table 5301.2(1) exceeds 20 psf (958 Pa).

5610.4.3 Interior Panels. The maximum area of each individual standard-unit panel shall be 250 square feet (23.2 m²). The maximum area of each thin-unit panel shall be 150 square feet (13.9 m²). The maximum dimension between structural supports shall be 25 feet (7620mm) in width or 20 feet (6096 mm) in height.

5610.4.4 Curved Panels. The width of curved panels shall conform to the requirements of 780CMR 5610.4.1, 5610.4.2 and 5610.4.3, except additional structural supports shall be provided at locations where a curved section joins a straight section, and at inflection points in multicurved walls.

5610.5 Panel Support. Glass unit masonry panels shall conform to the support requirements of 780 CMR 5610.5.

5610.5.1 Deflection. The maximum total deflection of structural members that support glass unit masonry shall not exceed 1/600.

5610.5.2 Lateral Support. Glass unit masonry panels shall be laterally supported along the top and sides of the panel. Lateral supports for glass unit masonry panels shall be designed to resist a minimum of 200 pounds per lineal foot (2918

N/m) of panel, or the actual applied loads, whichever is greater. Except for single unit panels, lateral support shall be provided by panel anchors along the top and sides spaced a maximum of 16 inches (406 mm) on center or by channel-type restraints. Single unit panels shall be supported by channel-type restraints.

Exceptions:

1. Lateral support is not required at the top of panels that are one unit wide.
2. Lateral support is not required at the sides of panels that are one unit high.

5610.5.2.1 Panel Anchor Restraints. Panel anchors shall be spaced a maximum of 16 inches (406 mm) on center in both jambs and across the head. Panel anchors shall be embedded a minimum of 12 inches (305 mm) and shall be provided with two fasteners so as to resist the loads specified in 780 CMR 5610.5.2.

5610.5.2.2 Channel-type Restraints. Glass unit masonry panels shall be recessed at least one inch (25.4 mm) within channels and chases. Channel-type restraints shall be oversized to accommodate expansion material in the opening, packing and sealant between the framing restraints, and the glass unit masonry perimeter units.

5610.6 Sills. Before bedding of glass units, the sill area shall be covered with a water base asphaltic emulsion coating. The coating shall be a minimum of 1/8 inch (3.2 mm) thick.

5610.7 Expansion Joints. Glass unit masonry panels shall be provided with expansion joints along

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the top and sides at all structural supports. Expansion joints shall be a minimum of $\frac{5}{8}$ inch (9.5 mm) in thickness and shall have sufficient thickness to accommodate displacements of the supporting structure. Expansion joints shall be entirely free of mortar and other debris and shall be filled with resilient material.

5610.8 Mortar. Glass unit masonry shall be laid with Type S or N mortar. Mortar shall not be retempered after initial set. Mortar unused within 1½ hours after initial mixing shall be discarded.

5610.9 Reinforcement. Glass unit masonry panels shall have horizontal joint reinforcement spaced a maximum of 16 inches (406 mm) on center located in the mortar bed joint. Horizontal joint reinforcement shall extend the entire length of the panel but shall not extend across expansion joints. Longitudinal wires shall be lapped a minimum of 6 inches (152 mm) at splices. Joint reinforcement shall be placed in the bed joint immediately below and above openings in the panel. The reinforcement shall have not less than two parallel longitudinal wires of size W1.7 or greater, and have welded cross wires of size W1.7 or greater.

5610.10 Placement. Glass units shall be placed so head and bed joints are filled solidly. Mortar shall not be furrowed. Head and bed joints of glass unit masonry shall be $\frac{1}{4}$ inch (6.4 mm) thick, except that vertical joint thickness of radial panels shall not be less than $\frac{1}{8}$ inch (3.2 mm) or greater than $\frac{5}{8}$ inch (15.9 mm). The bed joint thickness tolerance shall

be minus $\frac{1}{16}$ inch (1.6mm) and plus $\frac{1}{8}$ inch (3.2 mm). The head joint thickness tolerance shall be plus or minus $\frac{1}{8}$ inch (3.2 mm).

780 CMR 5611 INSULATING CONCRETE FORM WALL CONSTRUCTION

5611.1 General. Insulating concrete form (ICF) walls shall be designed and constructed in accordance with the provisions of 780 CMR 5611 or in accordance with the provisions of ACI 318. When ACI 318 is used to design insulating concrete form foundation walls, project drawings, typical details and specifications shall bear the seal of the Massachusetts-registered architect or Massachusetts-registered professional engineer responsible for design.

5611.2 Applicability Limits. The provisions of 780 CMR 5611.2 shall apply to the construction of insulating concrete form walls for buildings not greater than 60 feet (18288 mm) in plan dimensions, and floors not greater than 32 feet (9754 mm) or roofs not greater than 40 feet (12192mm) in clear span. Buildings shall not exceed two stories in height above-grade. Insulating concrete form walls shall comply with the requirements in 780 CMR Table 5611.2. Walls constructed in accordance with the provisions of 780 CMR 5611.2 shall be limited to buildings subjected to a maximum design wind speed of 150 miles per hour (241 km/h), a maximum ground snow load of 70 psf (3.35 kN/m²).

780 CMR TABLE 5611.2
REQUIREMENTS FOR ICF WALLS^{a,b,c}

WALL TYPE AND NOMINAL SIZE	MAXIMUM WALL WEIGHT (psf)	MINIMUM WIDTH OF VERTICAL CORE (inches)	MINIMUM THICKNESS OF VERTICAL CORE (inches)	MAXIMUM SPACING OF VERTICAL CORES (inches)	MAXIMUM SPACING OF HORIZONTAL CORES (inches)	MINIMUM WEB THICKNESS (inches)
3.5" Flat	44	N/A	N/A	N/A	N/A	N/A
5.5" Flat	69	N/A	N/A	N/A	N/A	N/A
7.5" Flat	94	N/A	N/A	N/A	N/A	N/A
9.5" Flat	119	N/A	N/A	N/A	N/A	N/A
6" Waffle-Grid	56	6.25	5	12	16	2
8" Waffle-Grid	76	7	7	12	16	2
6" Screen-Grid	53	5.5	5.5	12	12	N/A

For SI: 1 inch = 25.4 mm

a. For width "W", thickness "T", spacing, and web thickness, refer to Figures 5611.4 and 5611.5.

b. N/A indicates not applicable

c. Wall weight is based on a unit weight of concrete of 150 pcf (23.6kN/m³). The tabulated values do not include any allowance for interior and exterior finishes.

5611.3 Flat insulating Concrete Form Wall Systems. Flat ICF wall systems shall comply with 780 CMR Figure 5611.3 and shall have reinforcement in accordance with 780 CMR Tables 5611.3(1) and 5611.3(2) and 780 CMR 5611.7.

5611.4 Waffle-grid Insulating Concrete Form Wall Systems. Waffle-grid wall systems shall comply with 780 CMR Figure 5611.4 and shall have reinforcement in accordance with 780 CMR Tables 5611.3(1) and 5611.4(1) and 780 CMR 5611.7. The minimum core dimensions shall comply with 780 CMR Table 5611.4(2).

5611.5 Screen-grid Insulating Concrete Form Wall Systems. Screen-grid ICF wall systems shall comply with 780CMR Figure 5611.5 and shall have reinforcement in accordance with 780 CMR Tables 5611.3(1) and 5611.5 and 780 CMR 5611.7. The minimum core dimensions shall comply with 780CMR Table 5611.4(2).

5611.6 Material. Insulating concrete form wall materials shall comply with 780 CMR 5611.6.

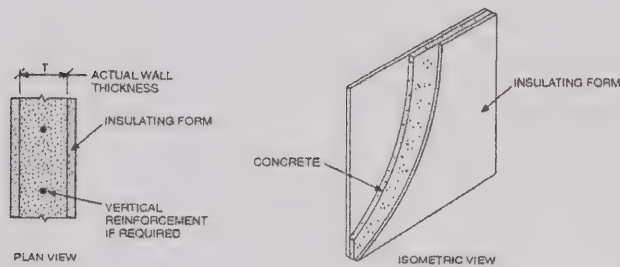
5611.6.1 Concrete Material. Ready-mixed concrete for insulating concrete form walls shall be in accordance with 780 CMR 5402.2. Maximum slump shall not be greater than 6 inches (152 mm) as determined in accordance with ASTM C 143. Maximum aggregate size shall not be larger than $\frac{3}{4}$ inch (19.1 mm).

Exception: Concrete mixes conforming to the ICF manufacturer's recommendations.

5611.6.2 Reinforcing Steel. Reinforcing steel shall meet the requirements of ASTM A 615, A 706 or A 996.

5611.6.3 Insulation Materials. Insulating concrete forms material shall meet the surface burning characteristics of 780 CMR 5314.1.1. A thermal barrier shall be provided on the building interior in accordance with 780 CMR 5314.1.2 or 780 CMR 5702.3.4.

**780 CMR FIGURE 5611.3
FLAT ICF WALL SYSTEM**



**780 CMR TABLE 5611.3(1)
DESIGN WIND PRESSURE FOR USE WITH 780 CMR TABLES 5611.3(2), 5611.4(1),
AND 780 CMR 5611.5 FOR ABOVE GRADE WALLS^a**

WIND SPEED (mph) ^e	DESIGN WIND PRESSURE (psf)					
	Enclosed ^b			Partially Enclosed ^b		
	Exposure ^c			Exposure ^c		
	B	C	D	B	C	D
85	18	24	29	23	31	37
90	20	27	32	25	35	41
100	24	34	39	31	43	51
110	29	41	48	38	52	61
120	35	48	57	45	62	73
130	41	56	66	53	73	85 ^d
140	47	65	77	61	84 ^d	99 ^d
150	54	75	88 ^d	70	96 ^d	114 ^d

For SI: 1 psf = 0.0479 kN/m²; 1 mph = 1.6093 km/hr

- This table is based on ASCE 7-98 components and cladding wind pressures using a mean roof height of 35 ft (10.7 m) and a tributary area of 10 ft² (0.9 m²).
- Buildings in wind borne debris regions as defined in 780 CMR 5202 shall be considered as "Partially Enclosed" unless glazed openings are protected in accordance with 780 CMR 5301.2.2.2 whereby the building shall be considered as "Enclosed." All other buildings shall be classified as "Enclosed."
- Exposure Categories shall be determined in accordance with 780 CMR 5301.2.1.4.
- For wind pressures greater than 80 psf (3.8 kN/m²), design is required in accordance with ACI 318 and approved manufacturer guidelines.
- Interpolation is permitted between wind speeds.

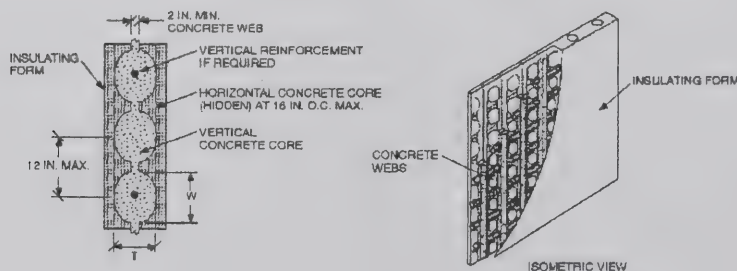
780 CMR TABLE 5611.3(2)
MINIMUM VERTICAL WALL REINFORCEMENT FOR FLAT
ICF ABOVE-GRADE WALLS^{a,b,c,d}

Design Wind Pressure [780 CMR Table 5611.3(1)] (psf)	Maximum Unsupported Wall Height (feet)	Minimum Vertical Reinforcement ^{d,e,f}					
		Non-Load Bearing Wall or Supporting Roof		Supporting Light-Frame Second Story and Roof		Supporting ICF Second Story and Roof	
		Minimum Wall Thickness (inches)					
		3.5 ^c	5.5	3.5 ^c	5.5	3.5 ^c	5.5
20	8	#4@48	#4@48	#4@48	#4@48	#4@48	#4@48
	9	#4@48	#4@48	#4@48	#4@48	#4@48	#4@48
	10	#4@38	#4@48	#4@40	#4@48	#4@42	#4@48
30	8	#4@42	#4@48	#4@46	#4@48	#4@48	#4@48
	9	#4@32; #5@48	#4@48	#4@34; #5@48	#4@48	#4@34; #5@48	#4@48
	10	Design Required	#4@48	Design Required	#4@48	Design Required	#4@48
40	8	#4@30; #5@48	#4@48	#4@30; #5@48	#4@48	#4@32; #5@48	#4@48
	9	Design Required	#4@42	Design Required	#4@46	Design Required	#4@48
	10	Design Required	#4@32; #5@48	Design Required	#4@34; #5@48	Design Required	#4@38
50	8	#4@20; #5@30	#4@42	#4@22; #5@34	#4@46	#4@24; #5@36	#4@48
	9	Design Required	#4@34; #5@48	Design Required	#4@34; #5@48	Design Required	#4@38
	10	Design Required	#4@26; #5@38	Design Required	#4@26; #5@38	Design Required	#4@28; #5@46
60	8	Design Required	#4@34; #5@48	Design Required	#4@36	Design Required	#4@40
	9	Design Required	#4@26; #5@38	Design Required	#4@28; #5@46	Design Required	#4@34; #5@48
	10	Design Required	#4@22; #5@34	Design Required	#4@22; #5@34	Design Required	#4@26; #5@38
70	8	Design Required	#4@28; #5@46	Design Required	#4@30; #5@48	Design Required	#4@34; #5@48
	9	Design Required	#4@22; #5@34	Design Required	#4@22; #5@34	Design Required	#4@24; #5@36
	10	Design Required	#4@16; #5@26	Design Required	#4@18; #5@28	Design Required	#4@20; #5@30
80	8	Design Required	#4@26; #5@38	Design Required	#4@26; #5@38	Design Required	#4@28; #5@46
	9	Design Required	#4@20; #5@30	Design Required	#4@20; #5@30	Design Required	#4@21; #5@34
	10	Design Required	#4@14; #5@24	Design Required	#4@14; #5@24	Design Required	#4@16; #5@26

For SI: 1 foot = 0.3048 m; 1 inch = 25.4 mm; 1 mph = 1.6093 km/hr.

- This table is based on reinforcing bars with a minimum yield strength of 40,000 psi (276 MPa) and concrete with a minimum specified compressive strength of 2,500 psi (17.2 MPa).
- Deflection criterion is $L/240$, where L is the height of the wall story in inches.
- Interpolation shall not be permitted.
- Reinforcement spacing for 3.5 inch (88.9 mm) walls shall be permitted to be multiplied by 1.6 when reinforcing steel with a minimum yield strength of 60,000 psi (414 MPa) is used. Reinforcement shall not be less than one #4 bar at 48 inches (1.2 m) on center.
- Reinforcement spacing for 5.5 inch (139.7 mm) walls shall be permitted to be multiplied by 1.5 when reinforcing steel with a minimum yield strength of 60,000 psi (414 MPa) is used. Reinforcement shall not be less than one #4 bar at 48 inches (1.2 m) on center.
- Also see 780 CMR 5611.7.1.2 when applicable.
- A 3.5-inch wall shall not be permitted if wood ledgers are used to support floor or roof loads. See Section 5611.8.

780 CMR FIGURE 5611.4
WAFFLE-GRID ICF WALL SYSTEM



780 CMR TABLE 5611.4(1)
MINIMUM VERTICAL WALL REINFORCEMENT FOR WAFFLE-GRID
ICF ABOVE-GRADE WALLS^{a,b,c}

Design Wind Pressure [780 CMR Table 5611.3(1)] (psf)	Maximum Unsupported Wall Height (feet)	MINIMUM VERTICAL REINFORCEMENT ^{d,e}					
		Non-Load Bearing Wall or Supporting Roof		Supporting Light-Frame Second Story and Roof		Supporting ICF Second Story and Roof	
		Minimum Wall Thickness (inches)					
		6	8	6	8	6	8
20	8	#4@48	#4@48	#4@48	#4@48	#4@48	#4@48
	9	#4@48	#4@48	#4@48	#4@48	#4@48	#4@48
	10	#4@48	#4@48	#4@48	#4@48	#4@48	#4@48
30	8	#4@48	#4@48	#4@48	#4@48	#4@48	#4@48
	9	#4@48	#4@48	#4@48	#4@48	#4@48	#4@48
	10	#4@36; #5@48	#4@48	#4@36; #5@48	#4@48	#4@36; #5@48	#4@48
40	8	#4@36; #5@48	#4@48	#4@48	#4@48	#4@48	#4@48
	9	#4@36; #5@48	#4@48	#4@36; #5@48	#4@48	#4@36; #5@48	#4@48
	10	#4@24; #5@36	#4@36; #5@48	#4@24; #5@36	#4@48	#4@24; #5@36	#4@48
50	8	#4@36; #5@48	#4@48	#4@36; #5@48	#4@48	#4@36; #5@48	#4@48
	9	#4@24; #5@36	#4@36; #5@48	#4@24; #5@36	#4@48	#4@24; #5@48	#4@48
	10	Design Required	#4@36; #5@48	Design Required	#4@36; #5@48	Design Required	#4@36; #5@48
60	8	#4@24; #5@36	#4@48	#4@24; #5@36	#4@48	#4@24; #5@48	#4@48
	9	Design Required	#4@36; #5@48	Design Required	#4@36; #5@48	Design Required	#4@36; #5@48
	10	Design Required	#4@24; #5@36	Design Required	#4@24; #5@36	Design Required	#4@24; #5@48
70	8	#4@24; #5@36	#4@36; #5@48	#4@24; #5@36	#4@36; #5@48	#4@24; #5@36	#4@48
	9	Design Required	#4@24; #5@36	Design Required	#4@24; #5@48	Design Required	#4@24; #5@48
	10	Design Required	#4@12; #5@36	Design Required	#4@24; #5@36	Design Required	#4@24; #5@36
80	8	#4@12; #5@24	#4@24; #5@48	#4@12; #5@24	#4@24; #5@48	#4@12; #5@24	#4@36; #5@48
	9	Design Required	#4@24; #5@36	Design Required	#4@24; #5@36	Design Required	#4@24; #5@36
	10	Design Required	#4@12; #5@24	Design Required	#4@12; #5@24	Design Required	#4@12; #5@24

For SI: 1 foot = 0.3048 m; 1 inch = 25.4 mm; 1 mph = 1.6093 km/hr.

- a. This table is based on reinforcing bars with a minimum yield strength of 40,000 psi (276 MPa) and concrete with a minimum specified compressive strength of 2,500 psi (17.2 MPa).
b. Deflection criterion is $L/240$, where L is the height of the wall story in inches.
c. Interpolation shall not be permitted.
d. Reinforcement spacing shall be permitted to be increased by 12 inches (305 mm) when reinforcing steel with a minimum yield strength of 60,000 psi (414 MPa) is used or No. 4 reinforcing bars shall be permitted to be substituted for #5 bars when reinforcing steel with a minimum yield strength of 60,000 psi (414 MPa) is used at the same spacing required for #5 bars. Reinforcement shall not be less than one #4 bar at 48 inches (1.2 m) on center.
e. Also see 780 CMR 5611.7.1.2 when applicable.

780 CMR TABLE 5611.4(2)
DIMENSIONAL REQUIREMENTS FOR CORES AND WEBS IN WAFFLE-GRID AND SCREEN-GRID ICF WALLS^{a,b}

WALL TYPE AND NOMINAL SIZE (inches)	MINIMUM WIDTH OF CORE (inches)	MINIMUM THICKNESS OF VERTICAL CORE (inches)	MAXIMUM SPACING OF VERTICAL CORES (inches)	MAXIMUM SPACING OF HORIZONTAL CORES (inches)	MINIMUM WEB THICKNESS (inches)
6" Waffle-Grid	6.25	5	12	16	2
8" Waffle-Grid	7	7	12	16	2
6" Screen-Grid	5.5	5.5	12	12	N/A

For SI: 1 inch = 25.4 mm.

- a. For width "W," thickness "T," spacing, and web thickness, refer to 780 CMR Figures 5611.4 and 5611.5.
b. N/A indicates not applicable.

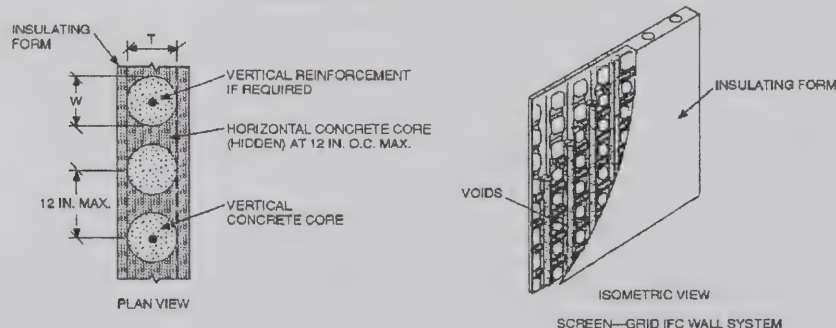
780 CMR TABLE 5611.5
MINIMUM VERTICAL WALL REINFORCEMENT FOR SCREEN-GRID ICF ABOVE-GRADE WALLS^{a,b,c}

DESIGN WIND PRESSURE TABLE 5611.3(1) (psf)	MAXIMUM UNSUPPORTED WALL HEIGHT (feet)	MINIMUM VERTICAL REINFORCEMENT ^{a,e}		
		Non-Load Bearing Wall or Supporting Roof	Supporting Light-Frame Second Story and Roof	Supporting ICF Second Story and Roof
20	8	#4@48	#4@48	#4@48
	9	#4@48	#4@48	#4@48
	10	#4@48	#4@48	#4@48
30	8	#4@48	#4@48	#4@48
	9	#4@48	#4@48	#4@48
	10	#4@36; #5@48	#4@48	#4@48
40	8	#4@48	#4@48	#4@48
	9	#4@36; #5@48	#4@36; #5@48	#4@48
	10	#4@24; #5@48	#4@24; #5@48	#4@24; #5@48
50	8	#4@36; #5@48	#4@36; #5@48	#4@48
	9	#4@24; #5@48	#4@24; #5@48	#4@24; #5@48
	10	Design Required	Design Required	Design Required
60	8	#4@24; #5@48	#4@24; #5@48	#4@36; #5@48
	9	#4@24; #5@36	#4@24; #5@36	#4@24; #5@36
	10	Design Required	Design Required	Design Required
70	8	#4@24; #5@36	#4@24; #5@36	#4@24; #5@36
	9	Design Required	Design Required	Design Required
	10	Design Required	Design Required	Design Required
80	8	#4@12; #5@36	#4@24; #5@36	#4@24; #5@36
	9	Design Required	Design Required	Design Required
	10	Design Required	Design Required	Design Required

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 1.6093 km/h.

- This table is based on reinforcing bars with a minimum yield strength of 40,000 psi (276 MPa) and concrete with a minimum specified compressive strength of 2,500 psi (17.2 MPa).
- Deflection criterion is $L/240$, where L is the height of the wall story in inches.
- Interpolation shall not be permitted.
- Reinforcement spacing shall be permitted to be increased by 12 inches (305mm) when reinforcing steel with a minimum yield strength of 60,000 psi (414 MPa) is used. Reinforcement shall not be less than one #4 bar at 48 inches (1.2 m) on center.
- Also see 780 CMR 5611.7.1.2 when applicable.

780 CMR FIGURE 5611.5
SCREEN-GRID ICF WALL SYSTEM



For SI: 1 inch = 25.4 mm.

5611.7 Wall Construction. Insulating concrete form walls shall be constructed in accordance with the provisions of 780 CMR 5611.7 and 780 CMR Figure 5611.7(1).

5611.7.1 Reinforcement

5611.7.1.1 Location. Vertical and horizontal wall reinforcement shall be placed within the middle third of the wall. Steel reinforcement shall have a minimum concrete cover in accordance with ACI 318.

Exception: Where insulated concrete forms are used and the form remains in place as cover for the concrete, the minimum concrete cover for the reinforcing steel is permitted to be reduced to $\frac{3}{4}$ inch (19.1 mm).

5611.7.1.2 Vertical Steel. Above-grade concrete walls shall have reinforcement in accordance with 780 CMR 5611.3, 5611.4 or 5611.5 and 5611.7.2. All vertical reinforcement in the top-most ICF story shall terminate with a bend or standard hook and be provided with a minimum lap splice of 24 inches (610 mm) with the top horizontal reinforcement.

Above-grade ICF walls shall be supported on concrete foundations reinforced as required for the above-grade wall immediately above, or in accordance with 780 CMR Tables 5404.4(1) through 5404.4(5), whichever requires the greater amount of reinforcement.

Vertical reinforcement shall be continuous from the bottom of the foundation wall to the roof. Lap splices, if required, shall comply with 780CMR 5611.7.1.5. Where vertical reinforcement in the above-grade wall is not continuous with the foundation wall reinforcement, dowel bars with a size and spacing to match the vertical ICF wall reinforcement shall be embedded $40d_b$ into the foundation wall and shall be lapped with

the above-grade wall reinforcement. Alternatively, for No. 6 and larger bars, the portion of the bar embedded in the foundation wall shall be embedded 24 inches (610 mm) in the foundation wall and shall have a standard hook.

5611.7.1.3 Horizontal Steel. Concrete walls with a minimum thickness of four inches (102 mm) shall have a minimum of one continuous No. 4 horizontal reinforcing bar placed at 32 inches (812 mm) on center with one bar within 12 inches (305 mm) of the top of the wall story. Concrete walls 5.5 inches (140 mm) thick or greater shall have a minimum of one continuous No. 4 horizontal reinforcing bar placed at 48 inches (1219 mm) on center with one bar located within 12 inches (305 mm) of the top of the wall story.

Horizontal reinforcement shall be continuous around building corners using corner bars or by bending the bars. In either case, the minimum lap splice shall be 24 inches (610 mm). For townhouses in Seismic Design Category C and for all buildings in Seismic Design Categories D₁ and D₂, each end of all horizontal reinforcement shall terminate with a standard hook or lap splice.

5611.7.1.4 Lap Splices. Where lap splicing of vertical or horizontal reinforcing steel is necessary, the lap splice shall be in accordance with 780 CMR Figure 5611.7.1.4 and a minimum of $40d_b$, where d_b is the diameter of the smaller bar. The maximum distance between noncontact parallel bars at a lap splice shall not exceed $8d_b$.

5611.7.1.5 Standard Hook. Where the free end of a reinforcing bar is required to have a standard hook, the hook shall be a 180-degree bend plus $4d_b$ extension but not less than $2\frac{1}{2}$ inches, or a 90-degree bend plus $12d_b$ extension.

780 CMR TABLE 5611.7(1)

MINIMUM WALL OPENING REINFORCEMENT REQUIREMENTS IN ICF WALLS

WALL TYPE AND OPENING WIDTH (L) (feet)	MINIMUM HORIZONTAL OPENING REINFORCEMENT	MINIMUM VERTICAL OPENING REINFORCEMENT
Flat, Waffle-, and Screen-Grid: $L < 2$ (0.61)	None required	None required
Flat, Waffle-, and Screen-Grid: $L \geq 2$ (0.61)	Provide lintels in accordance with 780 CMR 5611.7.3. Provide one No. 4 bar within 12 inches (305 mm) from the bottom of the opening. Top and bottom lintel reinforcement shall extend a minimum of 24 inches (610 mm) beyond the limits of the opening.	In locations with wind speeds less than or equal to 110 mph, provide one No. 4 bar for the full height of the wall story within 12 inches of each side of the opening. In locations with wind speeds greater than 110 mph, provide two No. 4 bars or one No. 5 bar for the full height of the wall story within 12 inches of each side of the opening.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 1.609 km/h.

NOTE: This table is based on concrete with a minimum specified compressive strength of 2,500 psi, reinforcing steel with minimum yield strength of 40,000 psi and an assumed equivalent rectangular cross section. This table is not intended to prohibit the use of ICF manufacturer's tables based on engineering analysis in accordance with ACI 318.

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780 CMR TABLE 5611.7(2)
MAXIMUM ALLOWABLE CLEAR SPANS FOR ICF LINTELS
FOR FLAT LOAD-BEARING WALLS^{a,b,c,d,f}
NO. 4 BOTTOM BAR SIZE

MINIMUM LINTEL THICKNESS, T (inches)	LINTEL DEPTH, D (inches)	MAXIMUM CLEAR SPAN, (feet-inches) (Number is Middle of Span, A)*					
		Supporting Roof Only		Supporting Light Framed 2nd Story and Roof		Supporting ICF Second Story and Roof	
		Ground Snow Load					
		30 psf	70 psf	30 psf	70 psf	30 psf	70 psf
3.5	8	4-9 (1-2)	4-2 (0-9)	3-10 (0-8)	3-4 (0-6)	3-5 (0-6)	3-1 (0-5)
	12	6-8 (1-11)	5-5 (1-3)	5-0 (1-1)	4-5 (0-10)	4-6 (0-10)	4-0 (0-8)
	16	7-11 (2-9)	6-5 (1-9)	6-0 (1-6)	5-3 (1-2)	5-4 (1-2)	4-10 (1-0)
	20	8-11 (3-5)	7-4 (2-3)	6-9 (1-11)	6-0 (1-6)	6-1 (1-7)	5-6 (1-3)
	24	9-10 (4-1)	8-1 (2-9)	7-6 (2-4)	6-7 (1-10)	6-9 (1-11)	6-1 (1-6)
5.5	8	5-2 (1-10)	4-2 (1-2)	3-10 (1-0)	3-5 (0-9)	3-5 (0-10)	3-1 (0-8)
	12	6-8 (3-0)	5-5 (2-0)	5-0 (1-9)	4-5 (1-4)	4-6 (1-4)	4-1 (1-1)
	16	7-10 (4-1)	6-5 (2-9)	6-0 (2-5)	5-3 (1-10)	5-4 (1-11)	4-10 (1-7)
	20	8-10 (5-3)	7-3 (3-6)	6-9 (3-1)	6-0 (2-4)	6-1 (2-5)	5-6 (2-0)
	24	9-8 (6-3)	8-0 (4-3)	7-5 (3-8)	6-7 (2-11)	6-8 (3-0)	6-0 (2-5)
7.5	8	5-2 (2-6)	4-2 (1-8)	3-11 (1-5)	3-5 (1-1)	3-6 (1-1)	3-2 (0-11)
	12	6-7 (4-0)	5-5 (2-8)	5-0 (2-4)	4-5 (1-10)	4-6 (1-10)	4-1 (1-6)
	16	7-9 (5-5)	6-5 (3-8)	5-11 (3-3)	5-3 (2-6)	5-4 (2-7)	4-10 (2-2)
	20	8-8 (6-10)	7-2 (4-8)	6-8 (4-2)	5-11 (3-3)	6-0 (3-4)	5-5 (2-9)
	24	9-6 (8-2)	7-11 (5-8)	7-4 (5-1)	6-6 (3-11)	6-7 (4-1)	6-0 (3-4)
9.5	8	5-2 (3-1)	4-2 (2-1)	3-11 (1-9)	3-5 (1-5)	3-6 (1-5)	3-2 (1-2)
	12	6-7 (5-0)	5-5 (3-4)	5-0 (3-0)	4-5 (2-4)	4-6 (2-5)	4-1 (1-11)
	16	7-8 (6-9)	6-4 (4-7)	5-11 (4-2)	5-3 (3-3)	5-4 (3-4)	4-10 (2-8)

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square inch = 6.895kN/m², 1 pound per square foot = 0.0479kN/m².

a. This table is based on concrete with a minimum specified compressive strength of 2,500 psi, reinforcing steel with a minimum yield strength of 40,000 psi and an assumed equivalent rectangular cross section. When reinforcement with a minimum yield strength of 60,000 psi is used, the span lengths in the shaded cells shall be increased by 1.2 times the table values.

b. This table is not intended to prohibit the use of ICF manufacturer's tables based on engineering analysis in accordance with ACI 318.

c. Deflection criteria: $L/240$.

d. Design load assumptions:

Floor dead load is 10 psf

Attic live load is 20 psf

Floor live load is 30 psf

Roof dead load is 15 psf

Building width is 32 feet

ICF wall dead load is 69 psf

Light-framed wall dead load is 10 psf

e. No. 3 stirrups are required at $d/2$ spacing except no stirrups are required for the distance, (A), shown in the middle portion of the span in accordance with 780 CMR Figure 5611.7(2) and 780 CMR 5611.7.3.2.

f. Interpolation is permitted between ground snow loads and between lintel depths.

780 CMR TABLE 5611.7(3)
MAXIMUM ALLOWABLE CLEAR SPANS FOR ICF LINTELS
FOR FLAT LOAD-BEARING WALLS^{a,b,c,d,f}
NO. 5 BOTTOM BAR SIZE

MINIMUM LINTEL THICKNESS, T (inches)	LINTEL DEPTH, D (inches)	MAXIMUM CLEAR SPAN, (feet-inches) (Number is Middle of Span, A)*					
		Supporting Roof		Supporting Light Framed 2nd Story and Roof		Supporting ICF Second Story and Roof	
		Ground Snow Load					
		30 psf	70 psf	30 psf	70 psf	30 psf	70 psf
3.5	8	4-9 (1-2)	4-2 (0-9)	3-11 (0-8)	3-7 (0-6)	3-7 (0-6)	3-5 (0-5)
	12	7-2 (1-11)	6-3 (1-3)	5-11 (1-1)	5-5 (0-10)	5-5 (0-10)	5-0 (0-8)
	16	9-6 (2-9)	8-0 (1-9)	7-4 (1-6)	6-6 (1-2)	6-7 (1-2)	5-11 (1-0)
	20	11-1 (3-5)	9-1 (2-3)	8-4 (1-11)	7-5 (1-6)	7-6 (1-7)	6-9 (1-3)
	24	12-2 (4-1)	10-0 (2-9)	9-3 (2-4)	8-2 (1-10)	8-4 (1-11)	7-6 (1-6)
5.5	8	5-6 (1-10)	4-10 (1-2)	4-7 (1-0)	4-2 (0-9)	4-2 (0-10)	3-10 (0-8)
	12	8-3 (3-0)	6-9 (2-0)	6-3 (1-9)	5-6 (1-4)	5-7 (1-4)	5-0 (1-1)
	16	9-9 (4-1)	8-0 (2-9)	7-5 (2-5)	6-6 (1-10)	6-7 (1-11)	6-0 (1-7)
	20	10-11 (5-3)	9-0 (3-6)	8-4 (3-1)	7-5 (2-4)	7-6 (2-5)	6-9 (2-0)
	24	12-0 (6-3)	9-11 (4-3)	9-3 (3-8)	8-2 (2-11)	8-3 (3-0)	7-6 (2-5)
7.5	8	6-1 (2-6)	5-2 (1-8)	4-9 (1-5)	4-3 (1-1)	4-3 (1-1)	3-10 (0-11)
	12	8-2 (4-0)	6-9 (2-8)	6-3 (2-4)	5-6 (1-10)	5-7 (1-10)	5-0 (1-6)
	16	9-7 (5-5)	7-11 (3-8)	7-4 (3-3)	6-6 (2-6)	6-7 (2-7)	6-0 (2-2)
	20	10-10 (6-10)	8-11 (4-8)	8-4 (4-2)	7-4 (3-3)	7-6 (3-4)	6-9 (2-9)
	24	11-10 (8-2)	9-10 (5-8)	9-2 (5-1)	8-1 (3-11)	8-3 (4-1)	7-5 (3-4)
9.5	8	6-4 (3-1)	5-2 (2-1)	4-10 (1-9)	4-3 (1-5)	4-4 (1-5)	3-11 (1-2)
	12	8-2 (5-0)	6-8 (3-4)	6-2 (3-0)	5-6 (2-4)	5-7 (2-5)	5-0 (1-11)
	16	9-6 (6-9)	7-11 (4-7)	7-4 (4-2)	6-6 (3-3)	6-7 (3-4)	5-11 (2-8)
	20	10-8 (8-4)	8-10 (5-10)	8-3 (5-4)	7-4 (4-2)	7-5 (4-3)	6-9 (3-6)
	24	11-7 (10-0)	9-9 (6-11)	9-0 (6-5)	8-1 (5-0)	8-2 (5-2)	7-5 (4-3)

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square inch = 6.895kN/m², 1 pound per square foot = 0.0479kN/m².

a. This table is based on concrete with a minimum specified compressive strength of 2,500 psi, reinforcing steel with a minimum yield strength of 40,000 psi and an assumed equivalent rectangular cross section. When reinforcement with a minimum yield strength of 60,000 psi is used the span lengths in the shaded cells shall be increased by 1.2 times the table values.

b. This table is not intended to prohibit the use of ICF manufacturer's tables based on engineering analysis in accordance with ACI 318.

c. Deflection criterion: $L/240$.

d. Design load assumptions:

Floor dead load is 10 psf

Floor live load is 30 psf

Building width is 32 feet

Light-framed wall dead load is 10 psf

Attic live load is 20 psf

Roof dead load is 15 psf

ICF wall dead load is 69 psf

e. No.3 stirrups are required at $d/2$ spacing except no stirrups are required for the distance, (A), shown in the middle portion of the span in accordance with 780 CMR Figure 5611.7(2) and 780 CMR 5611.7.3.2.

f. Interpolation is permitted between ground snow loads and between lintel depths.

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780 CMR TABLE 5611.7(4)
MAXIMUM ALLOWABLE CLEAR SPANS FOR WAFFLE-GRID ICF WALL LINTELS^{a,b,c,d,f}
NO. 4 BOTTOM BAR SIZE

NOMINAL LINTEL THICKNESS, <i>T_{v,h}</i> (inches)	LINTEL DEPTH, <i>D</i> (inches)	MAXIMUM CLEAR SPAN (feet-inches) (Number is Middle of Span, A)*					
		Supporting Roof		Supporting Light Framed 2nd Story and Roof		Supporting ICF Second Story and Roof	
		Ground Snow Load					
		30 psf	70 psf	30 psf	70 psf	30 psf	70 psf
6	8	5-2 (0-10)	4-2 (0-7)	3-10 (0-6)	3-5 (0-4)	3-6 (0-5)	3-2 (0-4)
	12	6-8 (1-5)	5-5 (0-11)	5-0 (0-9)	4-5 (0-7)	4-7 (0-8)	4-2 (0-6)
	16	7-11 (1-11)	6-6 (1-4)	6-0 (1-1)	5-3 (0-10)	5-6 (0-11)	4-11 (0-9)
	20	8-11 (2-6)	7-4 (1-8)	6-9 (1-5)	6-0 (1-1)	6-3 (1-2)	5-7 (0-11)
	24	9-10 (3-0)	8-1 (2-0)	7-6 (1-9)	6-7 (1-4)	6-10 (1-5)	6-2 (1-2)
8	8	5-2 (0-10)	4-3 (0-7)	3-11 (0-6)	3-5 (0-4)	3-7 (0-5)	3-2 (0-4)
	12	6-8 (1-5)	5-5 (0-11)	5-1 (0-9)	4-5 (0-7)	4-8 (0-8)	4-2 (0-6)
	16	7-10 (1-11)	6-5 (1-4)	6-0 (1-1)	5-3 (0-10)	5-6 (0-11)	4-11 (0-9)
	20	8-10 (2-6)	7-3 (1-8)	6-9 (1-5)	6-0 (1-1)	6-2 (1-2)	5-7 (0-11)
	24	9-8 (3-0)	8-0 (2-0)	7-5 (1-9)	6-7 (1-4)	6-10 (1-5)	6-2 (1-2)

For SI: 1 inch = 25.4 mm, 1 foot = 0.3048 m, 1 psi = 6.895 kN/m², 1 psf = 0.0479 kN/m².

- This table is based on concrete with a minimum specified compressive strength of 2,500 psi, reinforcing steel with a minimum yield strength of 40,000 psi and an assumed equivalent rectangular cross section. When reinforcement with a minimum yield strength of 60,000 psi is used the span lengths in the shaded cells shall be increased by 1.2 times the table values.
- This table is not intended to prohibit the use of ICF manufacturer's tables based on engineering analysis in accordance with ACI 318.
- Deflection criterion: $L/240$.
- Design load assumptions:

Floor dead load is 10 psf	Attic live load is 20 psf
Floor live load is 30 psf	Roof dead load is 15 psf
Building width is 32 feet	ICF wall dead load is 55 psf
Light-framed wall dead load is 10 psf	
- No. 3 stirrups are required at $d/2$ spacing except no stirrups are required for the distance, (A), shown in the middle portion of the span in accordance with 780 CMR Figure 5611.7(2) and 780 CMR 5611.7.3.2.
- Interpolation is permitted between ground snow loads and between lintel depths.
- For actual wall lintel width, refer to 780 CMR Table 5611.4(2)
- Lintel width corresponds to the nominal waffle-grid ICF wall thickness with a minimum thickness of two inches.

780 CMR TABLE 5611.7(5)
MAXIMUM ALLOWABLE CLEAR SPANS FOR WAFFLE-GRID ICF WALL LINTELS^{a,b,c,d,f}
NO. 5 BOTTOM BAR SIZE

NO. 5 BOTTOM BAR SIZE							
NOMINAL LINTEL THICKNESS, T_e^h (inches)	LINTEL DEPTH, D (inches)	MAXIMUM CLEAR SPAN (feet-inches) (Number is Middle of Span, A) ^e					
		Supporting Roof		Supporting Light Framed 2nd Story and Roof		Supporting ICF Second Story and Roof	
		Ground Snow Load					
		30 psf	70 psf	30 psf	70 psf	30 psf	70 psf
6	8	5-4 (0-10)	4-8 (0-7)	4-5 (0-6)	4-1 (0-4)	4-5 (0-5)	3-10 (0-4)
	12	8-10 (1-5)	6-9 (0-11)	6-3 (0-9)	5-6 (0-7)	6-3 (0-8)	5-1 (0-6)
	16	9-9 (1-11)	8-0 (1-4)	7-5 (1-1)	6-6 (0-10)	7-5 (0-11)	6-1 (0-9)
	20	11-0 (2-6)	9-1 (1-8)	8-5 (1-5)	7-5 (1-1)	8-5 (1-2)	6-11 (0-11)
	24	12-2 (3-0)	10-0 (2-0)	9-3 (1-9)	8-2 (1-4)	9-3 (1-5)	7-8 (1-2)
8	8	6-0 (0-10)	5-2 (0-7)	4-9 (0-6)	4-3 (0-4)	4-9 (0-5)	3-11 (0-4)
	12	8-3 (1-5)	6-9 (0-11)	6-3 (0-9)	5-6 (0-7)	6-3 (0-8)	5-2 (0-6)
	16	9-9 (1-11)	8-0 (1-4)	7-5 (1-1)	6-6 (0-10)	7-5 (0-11)	6-1 (0-9)
	20	10-11 (2-6)	9-0 (1-8)	8-4 (1-5)	7-5 (1-1)	8-4 (1-2)	6-11 (0-11)
	24	12-0 (3-0)	9-11 (2-0)	9-2 (1-9)	8-2 (1-4)	9-2 (1-5)	7-8 (1-2)

For SI: 1 inch = 25.4 mm, 1 foot = 0.3048 m, 1 psi = 6.895 kN/m², 1 psf = 0.0479 kN/m².

- This table is based on concrete with a minimum specified compressive strength of 2,500 psi, reinforcing steel with a minimum yield strength of 40,000 psi and an assumed equivalent rectangular cross section. When reinforcement with a minimum yield strength of 60,000 psi is used the span lengths in the shaded cells shall be increased by 1.2 times the table values.
- This table is not intended to prohibit the use of ICF manufacturer's tables based on engineering analysis in accordance with ACI 318.
- Deflection criterion: $L/240$.
- Design load assumptions:

Floor dead load is 10 psf	Attic live load is 20 psf
Floor live load is 30 psf	Roof dead load is 15 psf
Building width is 32 feet	ICF wall dead load is 53 psf
Light-framed wall dead load is 10 psf	
- No.3 stirrups are required at $d/2$ spacing except no stirrups are required for the distance, (A), shown in the middle portion of the span in accordance with 780 CMR Figure 5611.7(2) and 780 CMR 5611.7.3.2.
- Interpolation is permitted between ground snow loads and between lintel depths.
- For actual wall lintel width, refer to 780 CMR Table 5611.4(2)
- Lintel width corresponds to the nominal waffle-grid ICF wall thickness with a minimum thickness of 2 inches.

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780 CMR TABLE 5611.7(6)
MAXIMUM ALLOWABLE CLEAR SPANS FOR SCREEN-GRID ICF LINTELS
IN LOAD-BEARING WALLS^{a,b,c,d,e,f,g}
NO. 4 BOTTOM BAR SIZE

NO. 4 BOTTOM BAR SIZE							
MINIMUM LINTEL THICKNESS, <i>T</i> (inches) ^{h,j}	MINIMUM LINTEL DEPTH, <i>D</i> (inches)	MAXIMUM CLEAR SPAN (feet-inches)					
		Supporting Roof		Supporting Light-Frame Second Story and Roof		Supporting ICF Second Story and Roof	
		Maximum Ground Snow Load (psf)					
		30	70	30	70	30	70
6	12	3-7	2-10	2-5	2-0	2-0	NA
	24	9-10	8-1	7-6	6-7	6-11	6-2

For SI: 1 inch = 25.4 mm, 1 foot = 0.3048 m, 1 psi = 6.895kN/m², 1 psf = 0.0479 kN/m².

- This table is based on concrete with a minimum specified compressive strength of 2,500 psi, reinforcing steel with a minimum yield strength of 40,000 psi and an assumed equivalent rectangular cross section. When reinforcement with a minimum yield strength of 60,000 psi is used the span lengths in the shaded cells shall be increased by 1.2 times the table values.
- This table is not intended to prohibit the use of ICF manufacturer's tables based on engineering analysis in accordance with ACI 318.
- Deflection criterion: $L/240$
- Design load assumptions:
 - Floor dead load is 10 psf
 - Floor live load is 30 psf
 - Maximum floor clear span is 32 ft
 - Light-frame wall dead load is 10 psf
 - Attic live load is 20 psf
 - Roof dead load is 15 psf
 - ICF wall dead load is 53 psf
- Stirrup Requirements:
 - Stirrups are not required for lintels 12 inches deep.
 - One No. 3 stirrup is required in each vertical core for lintels 24 inches deep.
- Interpolation is permitted between ground snow loads.
- Flat ICF lintels may be used in *lieu* of screen-grid lintels.
- For actual wall lintel width, refer to 780 CMR Table 5611.4(2).
- Lintel width corresponds to the nominal screen-grid ICF wall thickness.

780 CMR TABLE 5611.7(7)
MAXIMUM ALLOWABLE CLEAR SPANS FOR SCREEN-GRID ICF LINTELS
IN LOAD-BEARING WALLS^{a,b,c,d,e,f,g}
NO. 5 BOTTOM BAR SIZE

NO. 5 BOTTOM BAR SIZE							
MINIMUM LINTEL THICKNESS, <i>T</i> (inches) ^{h,j}	MINIMUM LINTEL DEPTH, <i>D</i> (inches)	MAXIMUM CLEAR SPAN (feet-inches)					
		Supporting Roof		Supporting Light-Frame Second Story and Roof		Supporting ICF Second Story and Roof	
		Maximum Ground Snow Load (psf)					
		30	70	30	70	30	70
6	12	3-7	2-10	2-5	2-0	2-0	NA
	24	12-3	10-0	9-3	8-3	8-7	7-8

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square inch = 6.895kN/m², 1 pound per square foot = 0.0479kN/m².

- This table is based on concrete with a minimum specified compressive strength of 2,500 psi, reinforcing steel with a minimum yield strength of 40,000 psi and an assumed equivalent rectangular cross section. When reinforcement with a minimum yield strength of 60,000 psi is used the span lengths in the shaded cells shall be increased by 1.2 times the table values.
- This table is not intended to prohibit the use of ICF manufacturer's tables based on engineering analysis in accordance with ACI 318.
- Deflection criterion: $L/240$
- Design load assumptions:
 - Floor dead load is 10 psf
 - Floor live load is 30 psf
 - Maximum floor clear span is 32 ft
 - Light-frame wall dead load is 10 psf
 - Attic live load is 20 psf
 - Roof dead load is 15 psf
 - ICF wall dead load is 53 psf
- Stirrup Requirements:
 - Stirrups are not required for lintels 12 inches deep.
 - One No. 3 stirrup is required in each vertical core for lintels 24 inches deep.
- Interpolation is permitted between ground snow loads.
- Flat ICF lintels may be used in *lieu* of screen-grid lintels.
- For actual wall lintel width, refer to 780 CMR Table 5611.4(2).
- Lintel width corresponds to the nominal screen-grid ICF wall thickness.

780 CMR TABLE 5611.7(8)
MAXIMUM ALLOWABLE CLEAR SPANS FOR ICF LINTELS WITHOUT STIRRUPS IN
LOAD-BEARING WALLS^{a,b,c,d,e,f,g,h}
(NO. 4 OR NO. 5) BOTTOM BAR SIZE

		(NO. 4 OR NO. 5) BOTTOM BAR SIZE					
MINIMUM LINTEL THICKNESS, T (inches)	MINIMUM LINTEL DEPTH, D (inches)	MAXIMUM CLEAR SPAN (feet-inches)					
		Supporting Roof Only		Supporting Light-Frame Second Story and Roof		Supporting ICF Second Story and Roof	
		MAXIMUM GROUND SNOW LOAD (psf)					
		30	70	30	70	30	70
Flat ICF Lintel							
3.5	8	2-6	2-6	2-6	2-4	2-5	2-2
	12	4-2	4-2	4-1	3-10	3-10	3-7
	16	4-11	4-8	4-6	4-2	4-2	3-11
	20	6-3	5-3	4-11	4-6	4-6	4-3
	24	7-7	6-4	6-0	5-6	5-6	5-2
5.5	8	2-10	2-6	2-6	2-5	2-6	2-2
	12	4-8	4-4	4-3	3-11	3-10	3-7
	16	6-5	5-1	4-8	4-2	4-3	3-11
	20	8-2	6-6	6-0	5-4	5-5	5-0
	24	9-8	7-11	7-4	6-6	6-7	6-1
7.5	8	3-6	2-8	2-7	2-5	2-5	2-2
	12	5-9	4-5	4-4	4-0	3-10	3-7
	16	7-9	6-1	5-7	4-10	4-11	4-5
	20	8-8	7-2	6-8	5-11	6-0	5-5
	24	9-6	7-11	7-4	6-6	6-7	6-0
9.5	8	4-2	3-1	2-9	2-5	2-5	2-2
	12	6-7	5-1	4-7	3-11	4-0	3-7
	16	7-10	6-4	5-11	5-3	5-4	4-10
	20	8-7	7-2	6-8	5-11	6-0	5-5
	24	9-4	7-10	7-3	6-6	6-7	6-0
Waffle-Grid ICF Lintel							
6 or 8	8	2-6	2-6	2-6	2-4	2-4	2-2
	12	4-2	4-2	4-1	3-8	3-9	3-7
	16	5-9	5-8	5-7	5-1	5-2	4-8
	20	7-6	7-4	6-9	6-0	6-3	5-7
	24	9-2	8-1	7-6	6-7	6-10	6-2

For SI: 1 inch = 25.4 mm; 1 psf = 0.0479kN/m²; 1 ft = 0.3 m.

- Table values are based on tensile reinforcement with a minimum yield strength of 40,000 psi (276 MPa), concrete with a minimum specified compressive strength of 2,500 psi (17.2 MPa), and a building width (clear span) of 32 feet (9.8m).
- Spans located in shaded cells shall be permitted to be multiplied by 1.05 when concrete with a minimum compressive strength of 3,000 psi (20.7 MPa) is used or by 1.1 when concrete with a minimum compressive strength of 4,000 psi (27.6 MPa) is used.
- Deflection criterion is $L/240$, where L is the clear span of the lintel in inches.
- Linear interpolation shall be permitted between ground snow loads and between lintel depths.
- Lintel depth, D , shall be permitted to include the available height of ICF wall located directly above the lintel, provided that the increased lintel depth spans the entire length of the opening.
- Spans shall be permitted to be multiplied by 1.05 for a building width (clear span) of 28 feet (8.5 m).
- Spans shall be permitted to be multiplied by 1.1 for a building width (clear span) of 24 feet (7.3 m) or less.
- ICF wall dead load is 69 psf (3.3 kPa).

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780 CMR TABLE 5611.7(9)
MINIMUM BOTTOM BAR ICF LINTEL REINFORCEMENT FOR LARGE CLEAR SPANS
IN LOAD-BEARING WALLS^{a,b,c,d,e,f,h}

MINIMUM LINTEL THICKNESS, T ^g (inches)	MINIMUM LINTEL DEPTH, D (inches)	MINIMUM BOTTOM LINTEL REINFORCEMENT					
		Supporting Light-Frame Roof Only		Supporting Light-Frame Second Story and Roof		Supporting ICF Second Story and Light-Frame Roof	
		Maximum Ground Snow Load (psf)					
		30	70	30	70	30	70
Flat ICF Lintel, 12 Feet- 3 inches Maximum Clear Span							
3.5	24	1 #5	1 #7	D/R	D/R	D/R	D/R
5.5	20	1 #6	1 #7	D/R	D/R	D/R	D/R
	24	1 #5	1 #7	1 #7	1 #8	1 #8	D/R
7.5	16	1 #7; 2 #5	D/R	D/R	D/R	D/R	D/R
	20	1 #6; 2 #4	1 #7; 2 #5	1 #8; 2 #6	D/R	D/R	D/R
	24	1 #6; 2 #4	1 #7; 2 #5	1 #7; 2 #5	1 #8; 2 #6	1 #8; 2 #6	1 #8; 2 #6
9.5	16	1 #7; 2 #5	D/R	D/R	D/R	D/R	D/R
	20	1 #6; 2 #4	1 #7; 2 #5	1 #8; 2 #6	1 #8; 2 #6	1 #8; 2 #6	1 #9; 2 #6
	24	1 #7; 2 #4	1 #7; 2 #5	1 #7; 2 #5	1 #7; 2 #6	1 #8; 2 #6	1 #9; 2 #6
Flat ICF Lintel, 16 Feet-3 inches Maximum Clear Span							
5.5	24	1 #7	D/R	D/R	D/R	D/R	D/R
7.5	24	1 #7; 2 #5	D/R	D/R	D/R	D/R	D/R
9.5	24	1 #7; 2 #5	1 #9; 2 #6	1 #9; 2 #6	D/R	D/R	D/R
Waffle-Grid ICF Lintel, 12 Feet-3 inches Maximum Clear Span							
6	20	1 #6	D/R	D/R	D/R	D/R	D/R
	24	1 #5	1 #7; 2 #5	1 #7; 2 #5	1 #8; 2 #6	1 #8; 2 #6	D/R
8	16	1 #7; 2 #5	D/R	D/R	D/R	D/R	D/R
	20	1 #6; 2 #4	1 #7; 2 #5	1 #8; 2 #6	D/R	D/R	D/R
	24	1 #5	1 #7; 2 #5	1 #7; 2 #5	1 #8; 2 #6	1 #8; 2 #6	1 #8; 2 #6
Screen-Grid ICF Lintel, 12 Feet - 3 Inches Maximum Clear Span							
6	24	1 #5	1 #7	D/R	D/R	D/R	D/R

For SI: 1 inch = 25.4 mm, 1 foot = 0.3048 m, 1 psi = 6.895kN/m², 1 psf = 0.0479 kN/m².

- This table is based on concrete with a minimum specified compressive strength of 2,500 psi, reinforcing steel with a minimum yield strength of 40,000 psi and an assumed equivalent rectangular cross section. When reinforcement with a minimum yield strength of 60,000 psi is used the span lengths in the shaded cells shall be increased by 1.2 times the table values.
- This table is not intended to prohibit the use of ICF manufacturers tables based on engineering analysis in accordance with ACI 318.
- D/R indicates design is required.
- Deflection criterion: $L/240$.
- Interpolation is permitted between ground snow loads and between lintel depths.
- No. 3 stirrups are required a maximum $d/2$ spacing for spans greater than four feet.
- Actual thickness is shown for flat lintels while nominal thickness is given for waffle-grid and screen-grid lintels. Lintel thickness corresponds to the nominal waffle-grid and screen-grid ICF wall thickness. Refer to 780 CMR 5611.4(2) for actual wall thickness.
- ICF wall dead load varies based on wall thickness using 150 pcf concrete density.

780 CMR TABLE 5611.7(9A)
MINIMUM SOLID END WALL LENGTH REQUIREMENTS FOR FLAT ICF WALLS
(WIND PERPENDICULAR TO RIDGE)^{a,b,c}

WALL CATEGORY	BUILDING SIDE WALL LENGTH, L (feet)	Roof Slope	WIND VELOCITY PRESSURE FROM TABLE 5611.7.4 (psf)							
			20	25	30	35	40	45	50	60
			Minimum Solid Wall Length on Building End Wall (feet)							
One-Story or Top Story of Two-Story	16	≤ 1:12	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
		5:12	4.00	4.00	4.00	4.00	4.00	4.00	4.25	4.50
		7:12 ^d	4.00	4.25	4.25	4.50	4.75	4.75	5.00	5.50
		12:12 ^d	4.25	4.50	4.75	5.00	5.25	5.50	5.75	6.25
	24	≤ 1:12	4.00	4.00	4.00	4.00	4.00	4.00	4.25	4.50
		5:12	4.00	4.00	4.00	4.25	4.25	4.50	4.50	4.75
		7:12 ^d	4.25	4.50	4.75	5.00	5.25	5.50	5.75	6.25
		12:12 ^d	4.75	5.00	5.25	5.75	6.00	6.50	6.75	7.50
	32	≤ 1:12	4.00	4.00	4.00	4.00	4.25	4.25	4.50	4.75
		5:12	4.00	4.00	4.25	4.50	4.50	4.75	5.00	5.25
		7:12 ^d	4.50	5.00	5.25	5.50	6.00	6.25	6.50	7.25
		12:12 ^d	5.00	5.50	6.00	6.50	7.00	7.25	7.75	8.75
	40	≤ 1:12	4.00	4.00	4.25	4.25	4.50	4.50	4.75	5.00
		5:12	4.00	4.25	4.50	4.75	4.75	5.00	5.25	5.50
		7:12 ^d	4.75	5.25	5.75	6.00	6.50	7.00	7.25	8.00
		12:12 ^d	5.50	6.00	6.50	7.25	7.75	8.25	8.75	10.00
	50	≤ 1:12	4.00	4.25	4.25	4.50	4.75	4.75	5.00	5.50
		5:12	4.25	4.50	4.75	5.00	5.25	5.50	5.75	6.00
		7:12 ^d	5.25	5.75	6.25	6.75	7.25	7.75	8.25	9.25
		12:12 ^d	6.00	6.75	7.50	8.00	8.75	9.50	10.25	11.50
	60	≤ 1:12	4.00	4.25	4.50	4.75	5.00	5.25	5.25	5.75
		5:12	4.50	4.75	5.00	5.25	5.50	5.75	6.00	6.75
		7:12 ^d	5.50	6.25	6.75	7.50	8.00	8.50	9.25	10.25
		12:12 ^d	6.50	7.25	8.25	9.00	9.75	10.50	11.50	13.00
First Story of Two-Story	16	≤ 1:12	4.00	4.25	4.50	4.75	5.00	5.25	5.25	5.75
		5:12	4.50	4.75	5.00	5.25	5.50	5.75	6.00	6.75
		7:12 ^d	4.50	5.00	5.25	5.75	6.00	6.25	6.75	7.25
		12:12 ^d	5.00	5.25	5.75	6.25	6.50	7.00	7.25	8.25
	24	≤ 1:12	4.50	4.75	5.00	5.25	5.50	5.75	6.00	6.75
		5:12	4.75	5.25	5.50	6.00	6.25	6.75	7.00	7.75
		7:12 ^d	5.25	5.75	6.25	6.75	7.00	7.50	8.00	9.00
		12:12 ^d	5.50	6.25	6.75	7.25	8.00	8.50	9.00	10.25
	32	≤ 1:12	4.75	5.00	5.50	5.75	6.25	6.50	6.75	7.50
		5:12	5.25	5.75	6.25	6.75	7.25	7.50	8.00	9.00
		7:12 ^d	5.75	6.50	7.00	7.75	8.25	9.00	9.50	10.75
		12:12 ^d	6.25	7.00	7.75	8.50	9.25	10.00	10.75	12.25
	40	≤ 1:12	5.00	5.50	5.75	6.25	6.75	7.25	7.50	8.50
		5:12	5.50	6.25	6.75	7.25	8.00	8.50	9.00	10.25
		7:12 ^d	6.25	7.00	7.75	8.75	9.50	10.25	11.00	12.50
		12:12 ^d	7.00	8.00	8.75	9.75	10.75	11.50	12.50	14.25
	50	≤ 1:12	5.50	6.00	6.50	7.00	7.50	8.00	8.50	9.50
		5:12	6.00	6.75	7.50	8.25	9.00	9.75	10.50	11.75
		7:12 ^d	7.00	8.00	9.00	10.00	10.75	11.75	12.75	14.50
		12:12 ^d	7.75	9.00	10.00	11.25	12.25	13.50	14.75	17.00
	60	≤ 1:12	5.75	6.50	7.00	7.50	8.25	8.75	9.50	10.75
		5:12	6.75	7.50	8.25	9.25	10.00	10.75	11.75	13.25
		7:12 ^d	7.75	9.00	10.00	11.00	12.25	13.25	14.50	16.75
		12:12 ^d	8.75	10.00	11.50	12.75	14.00	15.50	16.75	19.50

For SI: 1 foot = 0.3048 m; 1 inch = 25.4 mm; 1 psf = 0.0479kN/m².

- Table values are based on a 3.5 in (88.9 mm) thick flat wall. For a 5.5 in (139.7 mm) thick flat wall, multiply the table values by 0.9. The adjusted values shall not result in solid wall lengths less than four feet.
- Table values are based on a maximum unsupported wall height of ten feet (3.0 m).
- Linear interpolation shall be permitted.
- The minimum solid wall lengths shown in the table are based on a building with an end wall length "W" of 60 feet and a roof slope of less than 7:12. For roof slopes of 7:12 or greater and end wall length "W" greater than 30 feet, the minimum solid wall length determined from the table shall be multiplied by: $1 + 0.4[(W-30)/30]$.

780 CMR TABLE 5611.7(9B)
MINIMUM SOLID SIDEWALL LENGTH REQUIREMENTS FOR FLAT ICF WALLS
(WIND PARALLEL TO RIDGE) ^{a,b,c,d}

WALL CATEGORY	BUILDING END WALL WIDTH, W(feet)	WIND VELOCITY PRESSURE FROM TABLE 5611.7.4 (psf)							
		20	25	30	35	40	45	50	60
One-Story or Top Story of Two-Story		Minimum Solid Wall Length on Building Side Wall (feet)							
	16	4.00	4.00	4.00	4.00	4.25	4.25	4.50	4.75
	24	4.00	4.25	4.50	4.75	4.75	5.00	5.25	5.50
	32	4.50	4.75	5.00	5.25	5.50	6.00	6.25	6.75
	40	5.00	5.50	5.75	6.25	6.75	7.00	7.50	8.25
	50	5.75	6.25	7.00	7.50	8.25	8.75	9.50	10.75
	60	6.50	7.50	8.25	9.25	10.00	10.75	11.75	13.25
First Story of Two-Story	16	4.25	4.50	4.75	5.00	5.25	5.50	5.75	6.50
	24	4.75	5.25	5.50	6.00	6.25	6.75	7.00	8.00
	32	5.50	6.00	6.50	7.00	7.50	8.00	8.75	9.75
	40	6.25	7.00	7.50	8.25	9.00	9.75	10.50	12.00
	50	7.25	8.25	9.25	10.25	11.25	12.25	13.25	15.25
	60	8.50	9.75	11.00	12.25	13.50	15.00	16.25	18.75

For SI: 1 foot = 0.3048 m; 1 inch = 25.4 mm; 1 psf = 0.0479kN/m².

- Table values are based on a 3.5 in (88.9mm) thick flat wall. For a 5.5 in (139.7mm) thick flat wall, multiply the table values by 0.9. The adjusted values shall not result in solid wall lengths less than four feet.
- Table values are based on a maximum unsupported wall height of ten feet (3.0 m).
- Table values are based on a maximum 12:12 roof pitch.
- Linear interpolation shall be permitted.

780 CMR TABLE 5611.7(10)
MAXIMUM ALLOWABLE CLEAR SPANS FOR ICF LINTELS IN NON-LOAD-BEARING
WALLS WITHOUT STIRRUPS^{a,b,c,d}
NO. 4 BOTTOM BAR

MINIMUM LINTEL THICKNESS, <i>T</i> (inches)	MINIMUM LINTEL DEPTH, <i>D</i> (inches)	MAXIMUM CLEAR SPAN	
		Supporting Light-Frame Non-Bearing Wall (feet-inches)	Supporting ICF Second Story and Non-Bearing Wall (feet-inches)
Flat ICF Lintel			
3.5	8	11-1	3-1
	12	15-11	5-1
	16	16-3	6-11
	20	16-3	8-8
	24	16-3	10-5
5.5	8	16-3	4-4
	12	16-3	7-0
	16	16-3	9-7
	20	16-3	12-0
	24	16-3	14-3
7.5	8	16-3	5-6
	12	16-3	8-11
	16	16-3	12-2
	20	16-3	15-3
	24	16-3	16-3
9.5	8	16-3	6-9
	12	16-3	10-11
	16	16-3	14-10
	20	16-3	16-3
	24	16-3	16-3
Waffle-Grid ICF Lintel			
6 or 8	8	9-1	2-11
	12	13-4	4-10
	16	16-3	6-7
	20	16-3	8-4
	24	16-3	9-11
Screen-Grid Lintel			
6	12	5-8	4-1
	24	16-3	9-1

For SI: 1 foot = 0.3048 m; 1 inch = 25.4 mm; 1 psf = 47.8804 Pa.

- This table is based on concrete with a minimum specified compressive strength of 2,500 psi, reinforcing steel with a minimum yield strength of 40,000 psi and an assumed equivalent rectangular cross section.
- This table is not intended to prohibit the use of ICF manufacturers tables based on engineering analysis in accordance with ACI 318.
- Deflection criterion is $L/240$, where L is the clear span of the lintel in inches.
- Linear interpolation is permitted between lintel depths.

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780 CMR TABLE 5611.7(10A)
MINIMUM SOLID END WALL LENGTH REQUIREMENTS FOR WAFFLE AND
SCREEN-GRID ICF WALLS (WIND PERPENDICULAR TO RIDGE)^{a,b,c}

WALL CATEGORY	BUILDING SIDE WALL LENGTH, L (feet)	ROOF SLOPE	WIND VELOCITY PRESSURE FROM TABLE 5611.7.4							
			20	25	30	35	40	45	50	60
			Minimum Solid Wall Length on Building End Wall (feet)							
One-Story or Top Story of Two-Story	16	≤1:12	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.25
		5:12	4.00	4.00	4.00	4.00	4.00	4.25	4.25	4.50
		7:12 ^d	4.00	4.25	4.50	4.75	5.00	5.25	5.50	6.00
		12:12 ^d	4.25	4.75	5.00	5.50	5.75	6.00	6.50	7.00
	24	≤1:12	4.00	4.00	4.00	4.00	4.00	4.25	4.25	4.50
		5:12	4.00	4.00	4.00	4.25	4.50	4.50	4.75	5.00
		7:12 ^d	4.50	4.75	5.00	5.50	5.75	6.25	6.50	7.25
		12:12 ^d	5.00	5.50	6.00	6.50	7.00	7.25	7.75	8.75
	32	≤1:12	4.00	4.00	4.00	4.25	4.25	4.50	4.75	5.00
		5:12	4.00	4.00	4.25	4.50	4.75	5.00	5.25	5.75
		7:12 ^d	4.75	5.25	5.75	6.25	6.50	7.00	7.50	8.50
		12:12 ^d	5.50	6.25	6.75	7.50	8.00	8.75	9.25	10.50
	40	≤1:12	4.00	4.00	4.25	4.50	4.50	4.75	5.00	5.50
		5:12	4.00	4.25	4.50	5.00	5.25	5.50	5.75	6.25
		7:12 ^d	5.25	5.75	6.25	7.00	7.50	8.00	8.50	9.75
		12:12 ^d	6.00	6.75	7.75	8.50	9.25	10	10.75	12.25
	50	≤1:12	4.00	4.25	4.50	4.75	5.00	5.25	5.50	6.00
		5:12	4.25	4.75	5.00	5.25	5.50	6.00	6.25	7.00
		7:12 ^d	5.75	6.50	7.00	7.75	8.50	9.25	9.75	11.25
		12:12 ^d	6.75	7.75	8.75	9.75	10.75	11.50	12.50	14.50
	60	≤1:12	4.25	4.50	4.75	5.00	5.25	5.50	5.75	6.50
		5:12	4.50	5.00	5.25	5.75	6.00	6.50	6.75	7.75
		7:12 ^d	6.25	7.00	8.00	8.75	9.50	10.25	11.25	12.75
		12:12 ^d	7.50	8.75	9.75	11.00	12	13.25	14.25	16.50
First Story of Two-Story	16	≤1:12	4.25	4.50	4.75	5.00	5.25	5.50	5.75	6.50
		5:12	4.50	5.00	5.25	5.75	6.00	6.50	6.75	7.75
		7:12 ^d	4.75	5.25	5.75	6.25	6.75	7.25	7.75	8.75
		12:12 ^d	5.25	5.75	6.50	7.00	7.50	8.00	8.75	9.75
	24	≤1:12	4.50	5.00	5.25	5.75	6.25	6.50	7.00	7.75
		5:12	5.00	5.75	6.25	6.75	7.25	7.75	8.25	9.25
		7:12 ^d	5.75	6.25	7.00	7.75	8.25	9.00	9.75	11.00
		12:12 ^d	6.25	7.00	7.75	8.50	9.50	10.25	11.00	12.75
	32	≤1:12	5.00	5.50	6.00	6.50	7.00	7.50	8.00	9.00
		5:12	5.75	6.25	7.00	7.75	8.25	9.00	9.75	11.00
		7:12 ^d	6.50	7.25	8.25	9.00	10.00	10.75	11.75	13.50
		12:12 ^d	7.25	8.25	9.25	10.25	11.25	12.50	13.50	15.50
	40	≤1:12	5.50	6.00	6.50	7.25	7.75	8.50	9.00	10.25
		5:12	6.25	7.00	7.75	8.75	9.50	10.25	11.00	12.75
		7:12 ^d	7.25	8.25	9.25	10.50	11.50	12.50	13.75	15.75
		12:12 ^d	8.00	9.50	10.75	12.00	13.25	14.50	15.75	18.25
First Story of Two-Story	50	≤1:12	6.00	6.75	7.50	8.00	8.75	9.50	10.25	11.75
		5:12	7.00	8.00	9.00	10.00	11.00	12.00	13.00	14.75
		7:12 ^d	8.25	9.50	10.75	12.25	13.50	14.75	16.00	18.75
		12:12 ^d	9.25	11.00	12.50	14.00	15.50	17.25	18.75	22.00
	60	≤1:12	6.50	7.25	8.25	9.00	10.00	10.75	11.75	13.25
		5:12	7.75	8.75	10.00	11.25	12.25	13.50	14.75	17.00
		7:12 ^d	9.25	10.75	12.25	14.00	15.50	17.00	18.50	21.75
		12:12 ^d	10.50	12.25	14.25	16.25	18.00	20.00	21.75	25.50

For SI: 1 foot = 0.3048 m; 1 inch = 25.4 mm; 1 psf = 0.0479kN/m².

a. Table values are based on a six inch (152.4mm) thick nominal waffle-grid wall. For an eight inch (203.2 mm) thick nominal waffle-grid wall, multiply the table values by 0.90.

b. Table values are based on a maximum unsupported wall height of ten feet (3.0 m).

c. Linear interpolation is permitted.

d. The minimum solid wall lengths shown in the table are based on a building with an end wall length "W" of 60 feet and a roof slope of less than 7:12. For roof slopes of 7:12 or greater and end wall length "W" greater than 30 feet, the minimum solid wall length determined from the table shall be multiplied by: $1 + 0.4 [(W-30)/30]$.

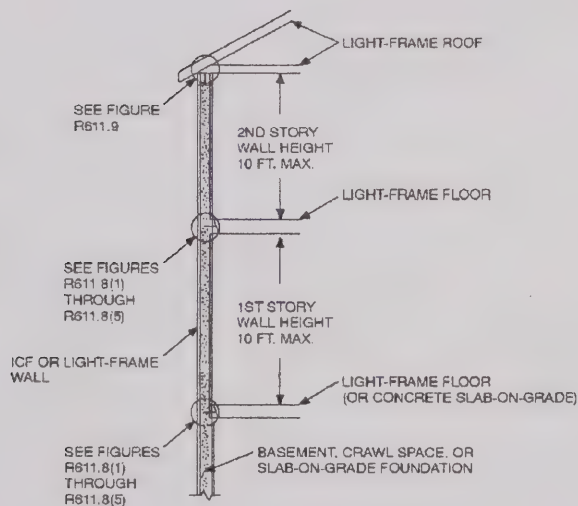
780CMR TABLE 5611.7(10B)
MINIMUM SOLID SIDE WALL LENGTH REQUIREMENTS FOR 6-INCH WAFFLE
AND SCREEN-GRID ICF WALLS (WIND PARALLEL TO RIDGE)^{a,b,c,d}

WALL CATEGORY	BUILDING END WALL WIDTH, W(feet)	WIND VELOCITY PRESSURE FROM TABLE 5611.7.4 (psf)							
		20	25	30	35	40	45	50	60
One-Story or Top Story of Two-Story		Minimum Solid Wall Length on Building Side Wall (feet)							
	16	4.00	4.00	4.00	4.25	4.25	4.50	4.75	5.00
	24	4.00	4.25	4.50	5.00	5.25	5.50	5.75	6.25
	32	4.50	5.00	5.50	5.75	6.25	6.75	7.00	8.00
	40	5.25	6.00	6.50	7.00	7.75	8.25	8.75	10.00
	50	6.50	7.25	8.00	9.00	9.75	10.75	11.50	13.25
First Story of Two-Story	60	7.75	8.75	10.00	11.25	12.25	13.5	14.50	17.0
	16	4.50	4.75	5.25	5.5	5.75	6.25	6.50	7.25
	24	5.00	5.75	6.25	6.75	7.25	7.75	8.25	9.50
	32	6.00	6.75	7.5	8.25	9.00	9.75	10.50	12.00
	40	7.00	8.00	9.00	10.0	11.00	12.00	13.00	15.00
	50	8.50	9.75	11.25	12.50	14.00	15.25	16.75	19.5
	60	10.25	12.00	13.75	15.50	17.25	19.00	21.00	24.50

For SI: 1 foot = 0.3048 m; 1 inch = 25.4 mm; 1 psf = 0.0479kN/m².

- Table values are based on a six inch (152.4mm) thick nominal waffle-grid wall. For an eight inch (203.2 mm) thick nominal waffle-grid wall, multiply the table values by 0.90.
- Table values are based on a maximum unsupported wall height of ten feet(3.0 m).
- Table values are based on a maximum 12:12 roof pitch.
- Linear interpolation shall be permitted.

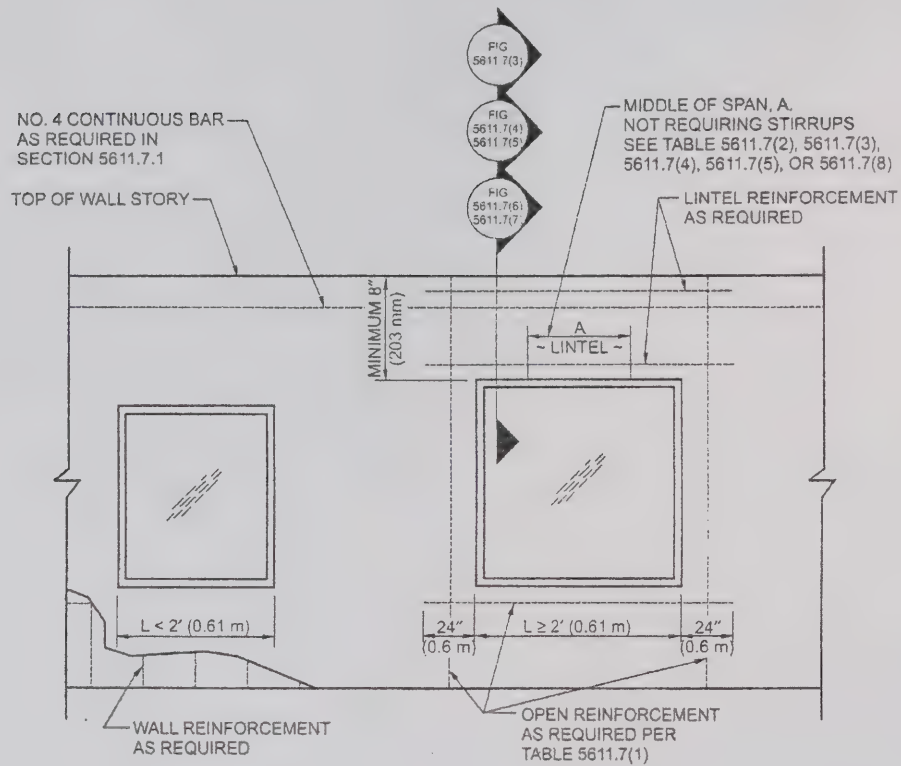
780 CMR 5611.7(1)
ICF WALL CONSTRUCTION



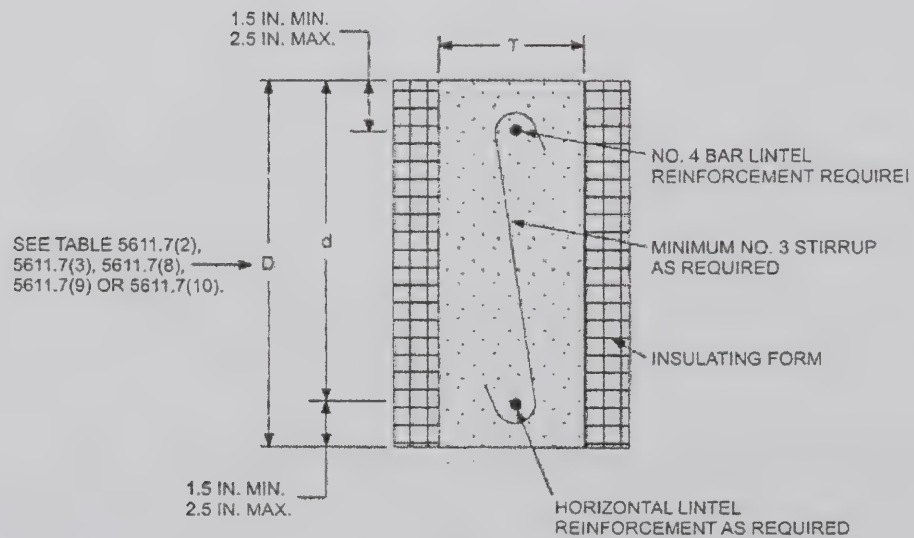
For SI: 1 foot = 304.8 mm.

Note: Section cut through flat wall or vertical core of waffle- or screen-grid wall.

**780 FIGURE 5611.7(2)
REINFORCEMENT OF OPENINGS**



**780 CMR FIGURE 5611.7(3)
ICF LINTELS FOR FLAT AND SCREEN-GRID WALLS**



For SI: 1 inch = 25.4 mm.
NOTE: Section cut through flat wall.

Diagram illustrating the horizontal reinforcement details for a vertical concrete core, showing dimensions and required reinforcement components:

- Dimensions:**
 - Top horizontal dimension: 1.5 IN. MIN., 2.5 IN. MAX.
 - Bottom horizontal dimension: 1.5 IN. MIN., 2.5 IN. MAX.
 - Core width: T
 - Core height: D
 - Core depth: d
- Reinforcement Components:**
 - MINIMUM NO. 3 STIRRUP AS REQUIRED
 - NO. 4 BAR LINTEL REINFORCEMENT REQUIRED
 - CONCRETE WEB (HIDDEN)
 - VERTICAL CONCRETE CORE
 - INSULATING FORM
 - HORIZONTAL LINTEL REINFORCEMENT AS REQUIRED
- Reference:** SEE TABLE 5611.7(4), 5611.7(5), 5611.7(8), 5611.7(9) OR 5611.7(10).

NOTE: Section cut through vertical core of a waffle-grid lintel.

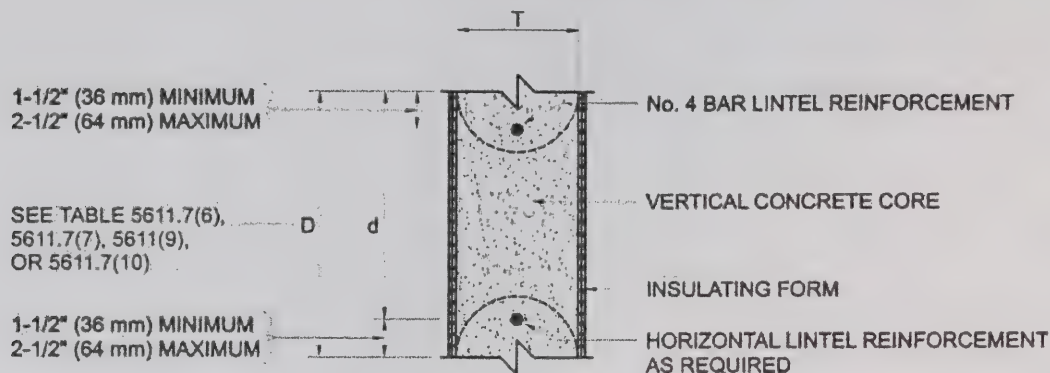
Diagram illustrating the cross-section of a vertical concrete core with horizontal lintel reinforcement. The diagram shows a central vertical concrete core (dotted pattern) surrounded by an insulating form (hatched pattern). The core is reinforced with horizontal lintel reinforcement (solid lines) and vertical stirrups (dashed lines). The diagram includes dimensions and labels:

- Top dimension: 1.5 IN. MIN. 2.5 IN. MAX.
- Bottom dimension: 1.5 IN. MIN. 2.5 IN. MAX.
- Horizontal dimension: T
- Vertical dimension: D
- Vertical dimension: d
- Labels:
 - NO. 4 BAR LINTEL REQUIREMENT REQUIRED
 - CONCRETE WEB (HIDDEN)
 - MINIMUM NO. 3 STIRRUP AS REQUIRED
 - VERTICAL CONCRETE CORE
 - INSULATING FORM
 - HORIZONTAL LINTEL REINFORCEMENT AS REQUIRED

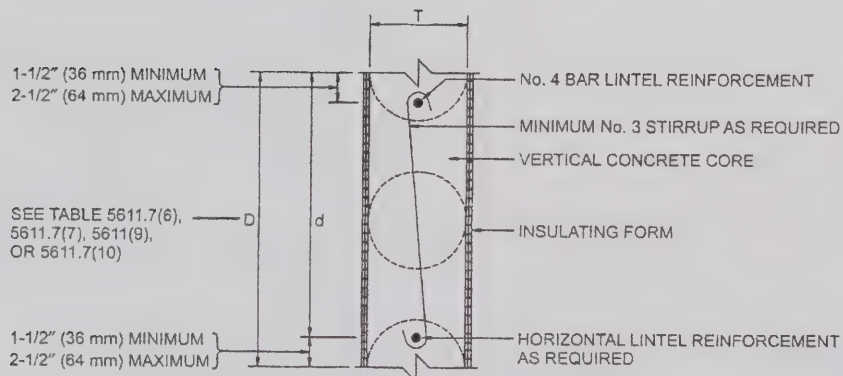
SEE TABLE 5611.7(4), 5611.7(5), 5611.7(8), 5611.7(9) OR 5611.7(10),

NOTE: Section cut through vertical core of a waffle-grid lintel.

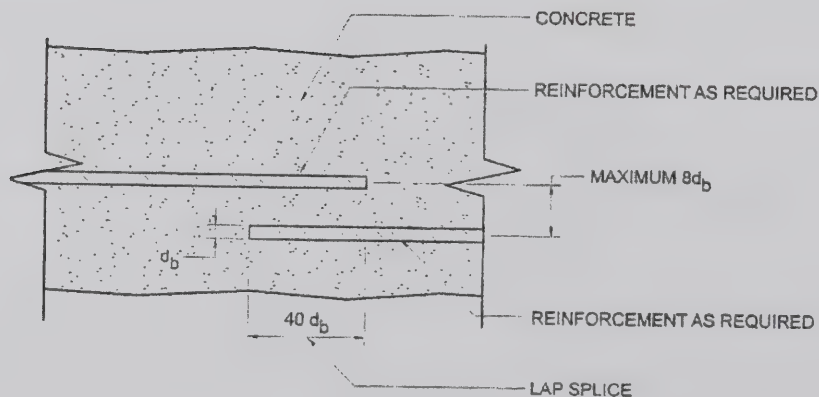
780 CMR FIGURE 5611.7(6)
SINGLE FORM HEIGHT SCREEN-GRID LINTEL



780 CMR FIGURE 5611.7(7)
DOUBLE FORM HEIGHT SCREEN-GRID LINTEL



780 CMR FIGURE 5611.7.1.4
LAP SPLICES



5611.7.2 Wall Openings. Wall openings shall have a minimum of eight inches (203 mm) of depth of concrete for flat and waffle-grid ICF walls and 12 inches (305 mm) for screen-grid walls over the length of the opening. When the depth of concrete above the opening is less than 12 inches for flat or waffle-grid walls, lintels in accordance with 780 CMR 5611.7.3 shall be provided. Reinforcement around openings shall be provided in accordance with 780 CMR Table 5611.7(1) and 780 CMR Figure 5611.7(2). All reinforcement placed horizontally above or below an opening shall extend a minimum of 24 inches (610 mm) beyond the limits of the opening. Wall opening reinforcement shall be provided in addition to the reinforcement required by 780 CMR 5611.3, 5611.4, 5611.5 and 5611.7.1. The perimeter of all wall openings shall be framed with a minimum two-inch by four-inch plate, anchored to the wall with ½-inch (12.7 mm) diameter anchor bolts spaced a maximum of 24 inches (610 mm) on center. The bolts shall be embedded into the concrete a minimum of four inches (102 mm) and have a minimum of 1½(38 mm) inches of concrete cover to the face of the wall.

Exception: The two-inch by four-inch plate is not required where the wall is formed to provide solid concrete around the perimeter of the opening with a minimum depth of four inches (102mm) for the full thickness of the wall.

5611.7.3 Lintels.

5611.7.3.1 General Requirements. Lintels shall be provided over all openings greater than or equal to two feet (610 mm) in width. Lintels for flat ICF walls shall be constructed in accordance with 780 CMR Figure 5611.7(3) and 780 CMR Table 5611.7(2) or 5611.7(3). Lintels for waffle-grid ICF walls shall be constructed in accordance with 780 CMR Figure 5611.7(4) or 780 CMR Figure 5611.7(5) and 780 CMR Table 5611.7(4) or 5611.7(5). Lintels for screen-grid ICF walls shall be constructed in accordance with 780 CMR Figure 5611.7(6) or 780 CMR Figure 5611.7(7). Lintel construction in accordance with 780 CMR Figure 5611.7(3) shall be permitted to be used with waffle-grid and screen-grid ICF wall construction. Lintel depths are permitted to be increased by the height of the ICF wall located directly above the opening, provided that the lintel depth spans the entire length of the opening.

5611.7.3.2 Stirrups. Where required, No. 3 stirrups shall be installed in flat, waffle-grid and screen-grid wall lintels in accordance with the following:

1. For flat walls the stirrups shall be spaced at a maximum spacing of $d/2$ where d equals the depth of the lintel (D) minus the bottom

cover of concrete as shown in 780 CMR Figure 5611.7(3). Stirrups shall not be required in the middle portion of the span (A) per 780 CMR Figure 5611.7(2), for flat walls for a length not to exceed the values shown in parenthesis in 780 CMR Tables 5611.7(2) and 5611.7(3) or for spans in accordance with 780 CMR Table 5611.7(8).

2. For waffle-grid walls a minimum of two No. 3 stirrups shall be placed in each vertical core of waffle-grid lintels. Stirrups shall not be required in the middle portion of the span (A) per 780 CMR Figure 5611.7(2), for waffle-grid walls for a length not to exceed the values shown in parenthesis in 780 CMR Tables 5611.7(4) and 5611.7(5) or for spans in accordance with 780 CMR Table 5611.7(8).

3. For screen-grid walls one No. 3 stirrup shall be placed in each vertical core of screen-grid lintels.

Exception: Stirrups are not required in Screen-grid lintels meeting the following requirements:

1. Lintel Depth (D) = 12 inches (305mm) - spans less than or equal three feet - seven inches
2. Lintel Depth (D) = 24 inches (610mm) - spans less than or equal four feet - four inches

5611.7.3.3 Horizontal Reinforcement.

One No. 4 horizontal bar shall be provided in the top of the lintel. Horizontal reinforcement placed within 12 inches (305 mm) of the top of the wall in accordance with 780 CMR 5611.7.1.3 shall be permitted to serve as the top or bottom reinforcement in the lintel provided the reinforcement meets the location requirements in 780 CMR Figure 5611.7(2), 5611.7(3), 5611.7(4), 5611.7(5), 5611.7(6), or 5611.7(7), and the size requirements in 780 CMR Tables 5611.7(2), 5611.7(3), 5611.7(4), 5611.7(5), 5611.7(6), 5611.7(7), or 5611.7(8).

5611.7.3.4 Load-bearing Walls. Lintels in flat ICF load-bearing walls shall comply with 780 CMR Table 5611.7(2), 780 CMR Table 5611.7(3) or 780 CMR Table 5611.7(8). Lintels in waffle-grid ICF load-bearing walls shall comply with 780 CMR Table 5611.7(4), 780 CMR Table 5611.7(5) or 780 CMR Table 5611.7(8). Lintels in screen-grid ICF load-bearing walls shall comply with 780 CMR Table 5611.7(6) or 780 CMR Table 5611.7(7).

Where spans larger than those permitted in 780 CMR Table 5611.7(2), 780 CMR Table 5611.7(3), 780 CMR Table 5611.7(4), 780 CMR Table 5611.7(5), 5611.7(6), 5611.7(7) or 5611.7(8) are required, the

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lintels shall comply with 780 CMR Table 5611.7 (9).

5611.7.3.5 Nonload-bearing Walls. Lintels in nonload-bearing flat, waffle-grid and screen-grid ICF walls shall comply with 780 CMR Table 5611.7 (10). Stirrups are not required.

5611.7.4 Minimum length of wall without openings. *The wind velocity pressures of 780 CMR Table 5611.7.4 shall be used to determine the minimum amount of solid wall length in accordance with 780 CMR Tables 5611.7(9A) through 5611.7(10B) and 780 CMR Figure 5611.7.4. The greater amount of solid wall length required by wind loading shall apply. The minimum percentage of solid wall length shall include only those solid wall segments that are a minimum of 24 inches (610 mm) in length. The maximum distance between wall segments included in determining solid wall length shall not exceed 18 feet (5486 mm). A minimum length of 24 inches (610 mm) of solid wall segment, extending the full height of each wall story, shall occur at all interior and exterior corners of exterior walls.*

780 CMR TABLE 5611.7.4
WIND VELOCITY PRESSURE FOR
DETERMINATION OF MINIMUM SOLID
WALL LENGTH^a

WIND SPEED (mph) ^d	VELOCITY PRESSURE (psf)		
	Exposure ^b		
	B	C	D
85	14	19	23
90	16	21	25
100	19	26	31
110	23	32	37
120	27	38	44
130	32	44	52
140	37	51	60
150	43	59	69 ^c

For SI: 1 psf = 0.0479 kN/m²; 1 mph = 1.6093 km/hr

a. Table values are based on ASCE 7-98 Figure 6-4 using a mean roof height of 35 ft (10.7 m).

b. Exposure Categories shall be determined in accordance with 780 CMR 5301.2.1.4.

c. Design is required in accordance with ACI 318 and approved manufacturer guidelines.

d. Interpolation is permitted between wind speeds.

5611.8 ICF Wall-to-floor Connections.

5611.8.1 Top Bearing. Floors bearing on the top of ICF foundation walls in accordance with 780 CMR Figure 5611.8(1) shall have the wood sill plate anchored to the ICF wall with minimum ½-inch (12.7 mm) diameter bolts embedded a minimum of seven inches (178 mm) and placed at a maximum spacing of six feet (1829mm) on center and not more than 12 inches (305 mm)

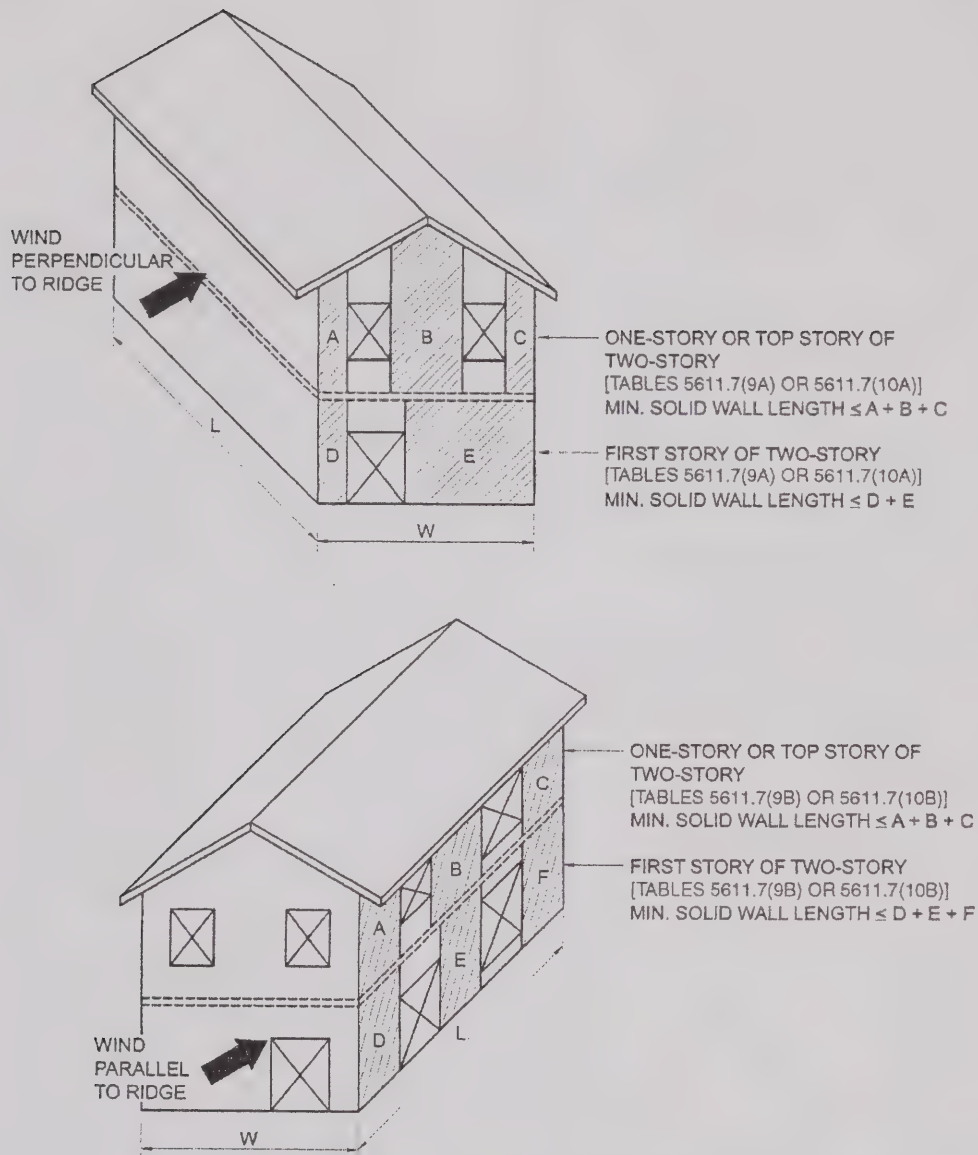
from corners. Anchor bolts for waffle-grid and screen-grid walls shall be located in the cores. In conditions where wind speeds are in excess of 90 miles per hour (144 km/h), the ½-inch (12.7 mm) diameter anchor bolts shall be placed at a maximum spacing of four feet (1219 mm) on center. Bolts shall extend a minimum of seven inches (178 mm) into concrete. Sill plates shall be protected against decay where required by 780 CMR 5319. Cold-formed steel framing systems shall be anchored to the concrete in accordance with 780 CMR 5505.3.1 or 780 CMR 5603.3.1.

5611.8.2 Ledger Bearing. Wood ledger boards supporting bearing ends of joists or trusses shall be anchored to flat ICF walls with minimum thickness of 5.5 inches (140 mm) and to waffle- or screen-grid ICF walls with minimum nominal thickness of six inches (152 mm) in accordance with 780 CMR Figure 5611.8(2), 5611.8(3), 5611.8(4) or 5611.8(5) and 780 CMR Table 5611.8(1). Wood ledger boards supporting bearing ends of joists or trusses shall be anchored to flat ICF walls with minimum thickness of 3.5 inches (140 mm) in accordance with 780 CMR Figure 5611.8(4) or 5611.8(5) and 780 CMR Table 5611.8(1). The ledger shall be a minimum 2 by 8, No. 2 Southern Pine or No. 2 Douglas Fir. Ledgers anchored to nonload-bearing walls to support floor or roof sheathing shall be attached with ½ inch (12.7 mm) diameter or headed anchor bolts spaced a maximum of six feet (1829 mm) on center. Anchor bolts shall be embedded a minimum of four inches (102 mm) into the concrete.

5611.8.3 Floor and Roof Diaphragm Construction. Floor and roof diaphragms shall be constructed of structural wood sheathing panels, attached to wood framing in accordance with 780 CMR Table 5602.3(1) or 780 CMR Table 5602.3(2) or to cold-formed steel floor framing in accordance with 780 CMR Table 5505.3.1(2) or to cold-formed steel roof framing in accordance with 780 CMR Table 5804.3.

5611.9 ICF Wall to Top Sill Plate (Roof) Connections. Wood sill plates attaching roof framing to ICF walls shall be anchored with minimum ½ inch (12.7 mm) diameter anchor bolt embedded a minimum of seven inches (178mm) and placed at six feet (1829 mm) on center in accordance with 780 CMR Figure 5611.9. Anchor bolts shall be located in the cores of waffle-grid and screen-grid ICF walls. Roof assemblies subject to wind uplift pressure of 20 pounds per square foot (1.44 kN/m²) or greater as established in 780 CMR Table 5301.2(2) shall have rafter or truss ties provided in accordance with 780 CMR Table 5802.11.

**780 CMR FIGURE 5611.7.4
MINIMUM SOLID WALL LENGTH**



NOTE: EACH WALL SEGMENT (A, B, C, D AND F) MUST MEET THE MINIMUM SOLID WALL SEGMENT LENGTH IN ORDER TO BE APPLICABLE TO THE MINIMUM SOLID WALL LENGTH EQUATIONS ABOVE.

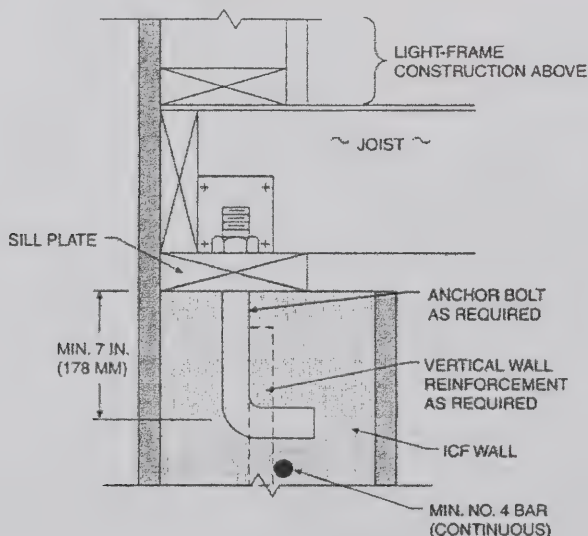
780 CMR TABLE 5611.8(1)
FLOOR LEDGER-ICF WALL CONNECTION (SIDE-BEARING CONNECTION) REQUIREMENTS^{a,b,c}

MAXIMUM FLOOR CLEAR SPAN ^d (feet)	MAXIMUM ANCHOR BOLT SPACING ^e (inches)			
	Staggered ½-inch-diameter anchor bolts	Staggered ⅝-inch-diameter anchor bolts	Two ½-inch-diameter anchor bolts ^f	Two ⅝-inch-diameter anchor bolts ^f
8	18	20	36	40
10	16	18	32	36
12	14	18	28	36
14	12	16	24	32
16	10	14	20	28
18	9	13	18	26
20	8	11	16	22
22	7	10	14	20
24	7	9	14	18
26	6	9	12	18
28	6	8	12	16
30	5	8	10	16
32	5	7	10	14

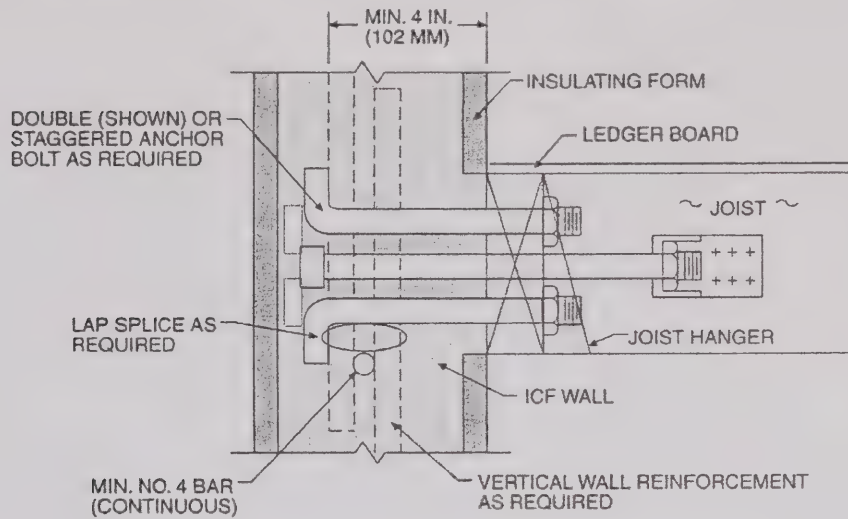
For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

- Minimum ledger board nominal depth shall be eight inches. The thickness of the ledger board shall be a minimum of two inches. Thickness of ledger board is in nominal lumber dimensions. Ledger board shall be minimum No. 2 Grade.
- Minimum edge distance shall be two inches for ½-inch-diameter anchor bolts and 2.5 inches for ⅝-inch-diameter anchor bolts.
- Interpolation is permitted between floor spans.
- Floor span corresponds to the clear span of the floor structure (i.e., joists or trusses) spanning between load-bearing walls or beams.
- Anchor bolts shall extend through the ledger to the center of the flat ICF wall thickness or the center of the horizontal or vertical core thickness of the waffle-grid or screen-grid ICF wall system.
- Minimum vertical distance between bolts shall be 1.5 inches for ½-inch-diameter anchor bolts and two inches for ⅝-inch-diameter anchor bolts.

780 CMR FIGURE 5611.8(1)
SECTION CUT THROUGH FLAT WALL OR VERTICAL CORE OF WAFFLE- OR
SCREEN-GRID WALL



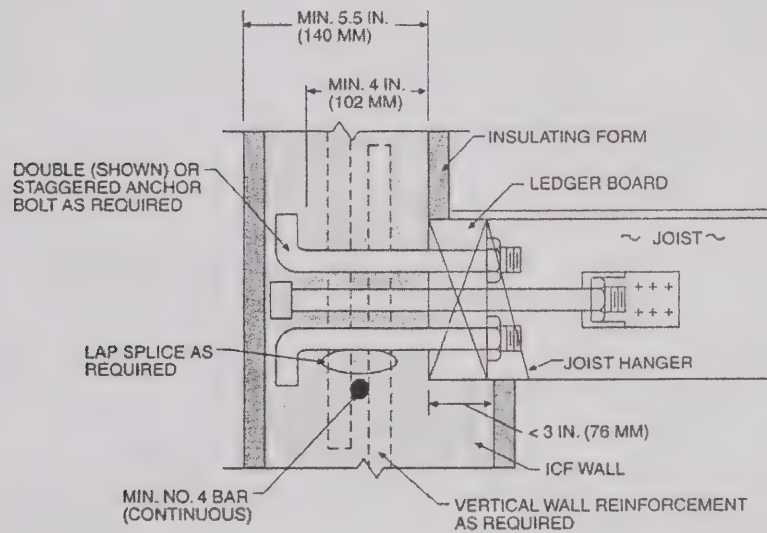
780 CMR FIGURE 5611.8(2)
FLOOR LEDGER—ICF WALL CONNECTION (SIDE-BEARING CONNECTION)



For SI: 1 inch = 25.4 mm.

NOTE: Section cut through flat wall or vertical core of a waffle- or screen-grid wall.

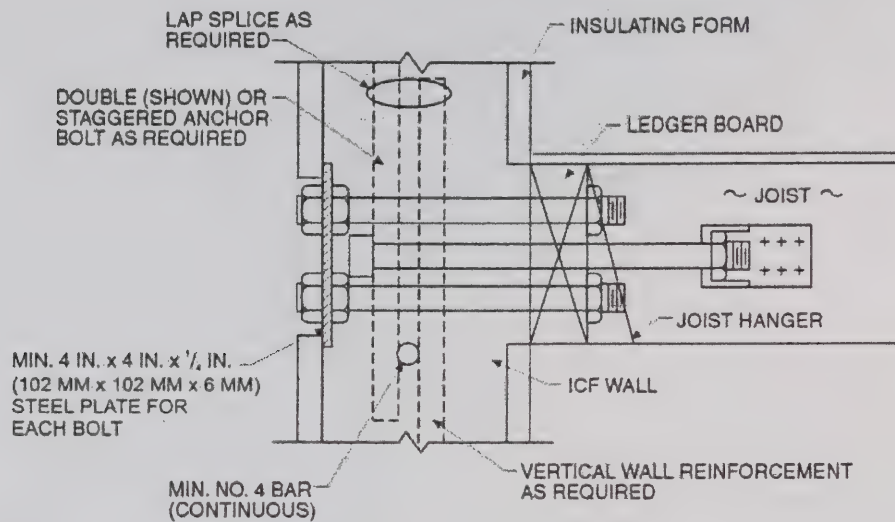
780 CMR FIGURE 5611.8(3)
FLOOR LEDGER—ICF WALL CONNECTION (LEDGE-BEARING CONNECTION)



For SI: 1 inch = 25.4 mm.

NOTE: Section cut through flat wall or vertical core of a waffle- or screen-grid wall.

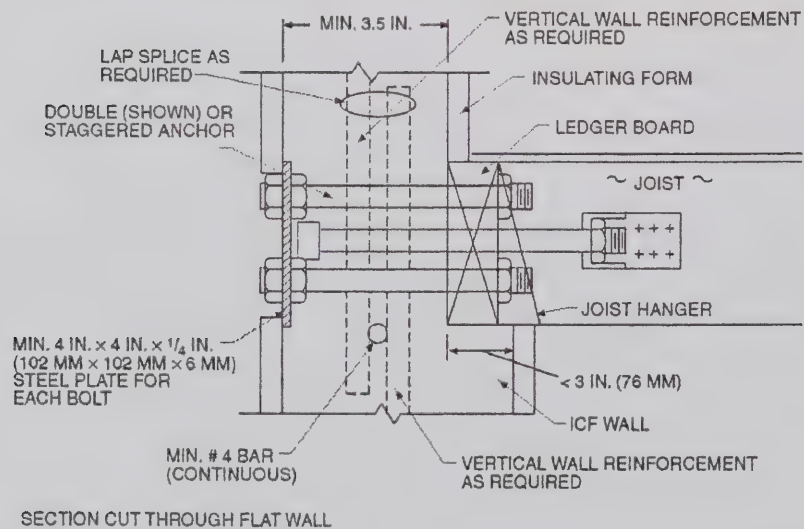
780 CMR FIGURE 5611.8(4)
WOOD FLOOR LEDGER—ICF WALL SYSTEM CONNECTION (THROUGH-BOLT
SIDE-BEARING CONNECTION)



For SI: 1 inch = 25.4 mm.

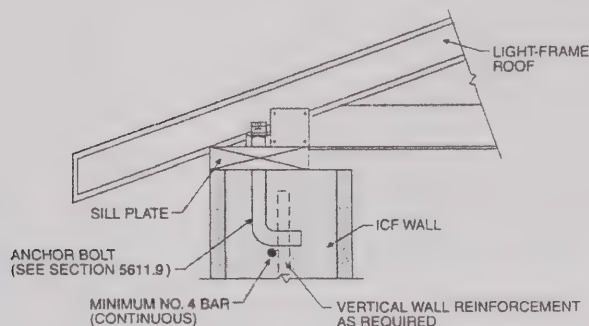
NOTE: Section cut through flat wall.

780 CMR FIGURE 5611.8(5)
FLOOR LEDGER—ICF WALL CONNECTION



For SI: 1 inch = 25.4 mm.

**780 CMR FIGURE 5611.9
ROOF SILL PLATE—ICF WALL CONNECTION**



NOTE: Section cut through flat wall or vertical core of a waffle- or screen-grid wall.

780 CMR 5612 CONVENTIONALLY FORMED CONCRETE WALL CONSTRUCTION

5612.1 General. Conventionally formed concrete walls with flat surfaces shall be designed and constructed in accordance with the provisions of 780 CMR 5611 for Flat ICF walls or in accordance with the provisions of ACI 318.

780 CMR 5613 EXTERIOR WINDOWS AND GLASS DOORS

5613.1 General. 780 CMR 5613 prescribes performance and construction requirements for exterior window systems installed in wall systems. Waterproofing, sealing and flashing systems are not included in the scope of 780 CMR 5613.

5613.2 Performance. Exterior windows and doors shall be designed to resist the design wind loads specified in 780 CMR Table 5301.2(2) adjusted for height and exposure per 780 CMR Table 5301.2(3).

5613.3 Testing and Labeling. Exterior windows and glass doors shall be tested by an approved independent laboratory, and bear a label identifying manufacturer, performance characteristics and approved inspection agency to indicate compliance with the requirements of one of the following specifications:

AAMA/NWDA 101/I.S.2
AAMA/WDMA 101/I.S.2/NAFS

Exceptions:

1. Decorative glazed openings.
2. Exterior window and door assemblies not included within the scope of AAMA/NWDA 101/I.S.2 or AAMA/WDMA 101/I.S.2/NAFS shall be tested in accordance with ASTM E 330. Assemblies covered by this exception containing glass shall comply with 780 CMR 5308.5.
3. Structural wind load design pressures for window units smaller than the size tested in accordance with 780 CMR 5613 shall be permitted to be higher than the design value of

the tested unit provided such higher pressures are determined by accepted engineering analysis. All components of the small unit shall be the same as the tested unit. Where such calculated design pressures are used they shall be validated by an additional test of the window unit having the highest allowable design pressure.

5613.4 Windborne Debris Protection. Protection of exterior windows and glass doors in buildings located in hurricane-prone regions from windborne debris shall be in accordance with 780 CMR 5301.2.1.2.

5613.5 Anchorage Methods. The methods cited in 780 CMR 5613.5 apply only to anchorage of window and glass door assemblies to the main force-resisting system.

5613.5.1 Anchoring Requirements. Window and glass door assemblies shall be anchored in accordance with the published manufacturer's recommendations to achieve the design pressure specified. Substitute anchoring systems used for substrates not specified by the fenestration manufacturer shall provide equal or greater anchoring performance as demonstrated by accepted engineering practice.

5613.5.2 Anchorage Details. Products shall be anchored in accordance with the minimum requirements illustrated in 780 CMR Figures 5613.5(1), 5613.5(2), 5613.5(3), 5613.5(4), 5613.5(5), 5613.5(6), 5613.5(7) and 5613.5(8).

5613.5.2.1 Masonry, Concrete or Other Structural Substrate. Where the wood shim or buck thickness is less than 1½ inches (38mm), window and glass door assemblies shall be anchored through the jamb, or by jamb clip and anchors shall be embedded directly into the masonry, concrete or other substantial substrate material. Anchors shall adequately transfer load from the window or door frame into the rough opening substrate (see 780 CMR Figures 5613.5(1) and 5613.5(2)).

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Where the wood shim or buck thickness is 1.5 inches (38 mm) or greater, the buck is securely fastened to the masonry, concrete or other substantial substrate and the buck extends beyond the interior face of the window or door frame, window and glass door assemblies shall be anchored through the jamb, or by jamb clip, or through the flange to the secured wood buck. Anchors shall be embedded into the secured wood buck to adequately transfer load from the window or door frame assembly (780 CMR Figures 5613.5(3), 5613.5(4) and 5613.5(5)).

5613.5.2.2 Wood or Other Approved Framing Material. Where the framing material is wood or other approved framing material, window and glass door assemblies shall be anchored through the frame, or by frame clip, or through the flange. Anchors shall be embedded into the frame construction to adequately transfer load (780 CMR Figures 5613.5(6), 5613.5(7) and 5613.5(8)).

5613.6 Mullions Occurring Between Individual Window and Glass Door Assemblies.

5613.6.1 Mullions. Mullions shall be tested by an approved testing laboratory or be engineered in accordance with accepted engineering practice. Both methods shall use performance criteria cited in 780 CMR 5613.6.2, 5613.6.3 and 5613.6.4.

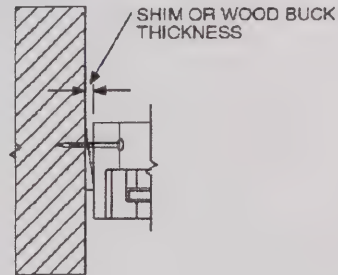
5613.6.2 Load Transfer. Mullions shall be designed to transfer the design pressure loads applied by the window and door assemblies to the rough opening substrate.

5613.6.3 Deflection. Mullions shall be capable of resisting the design pressure loads applied by the window and door assemblies to be supported without deflecting more than $L/175$, where L = the span of mullion in inches.

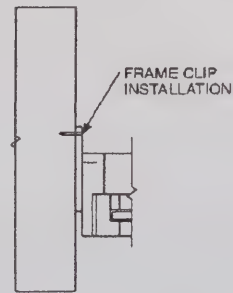
5613.6.4 Structural Safety Factor. Mullions shall be capable of resisting a load of 1.5 times

the design pressure loads applied by the window and door assemblies to be supported without exceeding the appropriate material stress levels. If tested by an approved laboratory, the 1.5 times the design pressure load shall be sustained for ten seconds, and the permanent deformation shall not exceed 0.4% of the mullion span after the 1.5 times design pressure load is removed.

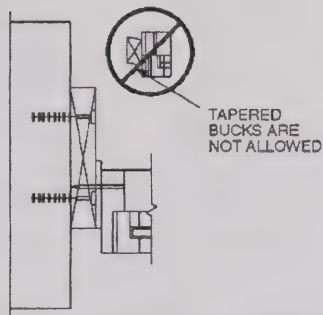
**780 CMR FIGURE 5613.5(1)
THROUGH THE FRAME**



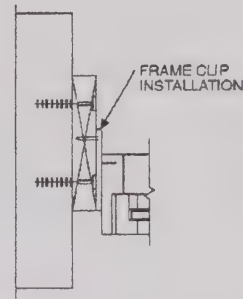
**780 CMR FIGURE 5613.5(2)
FRAME CLIP**



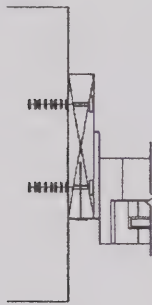
APPLY FRAME CLIP TO WINDOW OR DOOR IN
ACCORDANCE WITH PUBLISHED
MANUFACTURER'S RECOMMENDATIONS.

**780 CMR FIGURE 5613.5(3)
THROUGH THE FRAME**

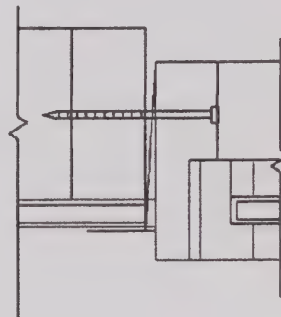
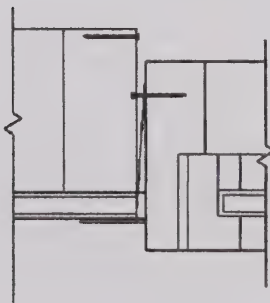
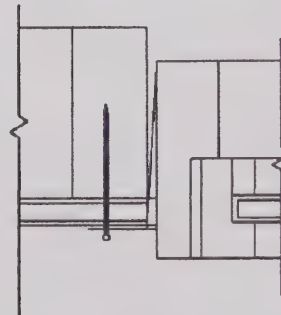
THROUGH THE FRAME ANCHORING METHOD. ANCHORS SHALL BE PROVIDED TO TRANSFER LOAD FROM THE WINDOW OR DOOR FRAME INTO THE ROUGH OPENING SUBSTRATE.

**780 CMR FIGURE 5613.5(4)
FRAME CLIP**

APPLY FRAME CLIP TO WINDOW OR DOOR FRAME IN ACCORDANCE WITH PUBLISHED MANUFACTURER'S RECOMMENDATIONS. ANCHORS SHALL BE PROVIDED TO TRANSFER LOAD FROM THE FRAME CLIP INTO THE ROUGH OPENING SUBSTRATE

**780 CMR FIGURE 5613.5(5)
THROUGH THE FLANGE**

APPLY ANCHORS THROUGH FLANGE IN ACCORDANCE WITH PUBLISHED MANUFACTURERS RECOMMENDATIONS

**780 CMR FIGURE 5613.5(6)
THROUGH THE FRAME****780 CMR FIGURE 5613.5(7)
FRAME CLIP****780 CMR FIGURE 5613.5(8)
THROUGH THE FLANGE**

780 CMR 57.00

WALL COVERING

780 CMR 5701 GENERAL

5701.1 Application. The provisions of 780CMR 57.00 shall control the design and construction of the interior and exterior wall covering for all one and two family dwellings and accessory buildings.

5701.2 Installation. Products sensitive to adverse weather shall not be installed until adequate weather protection for the installation is provided. Exterior sheathing shall be dry before applying exterior cover.

780 CMR 5702 INTERIOR COVERING

5702.1 General. Interior coverings or wall finishes shall be installed in accordance with 780CMR 57.00 and 780 CMR Tables 5702.1(1), Table 5702.1(2), Table 5702.1(3) and Table 5702.3.5. Interior masonry veneer shall comply with the requirements of 780 CMR 5703.7.1 for support and 780 CMR 5703.7.4 for anchorage, except an air space is not required. Interior finishes and materials shall conform to the flame spread and smoke-density requirements of 780 CMR 5315.

**780 CMR TABLE 5702.1(1)
THICKNESS OF PLASTER**

PLASTER BASE	FINISHED THICKNESS OF PLASTER FROM FACE OF LATH, MASONRY, CONCRETE (inches)	
	Gypsum plaster	Portland cement mortar
Expanded metal lath	$\frac{5}{8}$, minimum ^a	$\frac{5}{8}$, minimum ^a
Wire lath	$\frac{5}{8}$, minimum ^a	$\frac{3}{4}$, minimum (interior) ^b $\frac{7}{8}$, minimum (exterior) ^b
Gypsum lath ^e	$\frac{1}{2}$, minimum	$\frac{3}{4}$, minimum (interior) ^b
Masonry walls ^c	$\frac{1}{2}$, minimum	$\frac{1}{2}$, minimum
Monolithic concrete walls ^{c,d}	$\frac{5}{8}$, maximum	$\frac{7}{8}$, maximum
Monolithic concrete ceilings ^{c,d}	$\frac{3}{8}$, maximum ^e	$\frac{1}{2}$, maximum
Gypsum veneer base ^{f,g}	$\frac{1}{16}$, minimum	$\frac{3}{4}$, minimum (interior) ^b
Gypsum sheathing ^g	—	$\frac{3}{4}$, minimum (interior) ^b $\frac{7}{8}$, minimum (exterior) ^b

For SI: 1 inch = 25.4 mm.

- When measured from back plane of expanded metal lath, exclusive of ribs, or self-furring lath, plaster thickness shall be $\frac{3}{4}$ inch minimum.
- When measured from face of support or backing.
- Because masonry and concrete surfaces may vary in plane, thickness of plaster need not be uniform.
- When applied over a liquid bonding agent, finish coat may be applied directly to concrete surface.
- Approved acoustical plaster may be applied directly to concrete or over base coat plaster, beyond the maximum plaster thickness shown.
- Attachment shall be in accordance with 780 CMR Table 5702.3 .5.
- Where gypsum board is used as a base for portland cement plaster, weather-resistant sheathing paper complying with 780 CMR 5703.2 shall be provided.

**780 CMR TABLE 5702.1(2)
GYPSUM PLASTER PROPORTIONS^a**

NUMBER	COAT	PLASTER BASE OR LATH	MAXIMUM VOLUME AGGREGATE PER 100 POUNDS NEAT PLASTER ^b (cubic feet)	
			Damp loose sand ^a	Perlite or vermiculite ^c
Two-coat work	Base coat	Gypsum lath	2.5	2
	Base coat	Masonry	3	3
Three-coat work	First coat	Lath	2 ^d	2
	Second coat	Lath	3 ^d	2 ^c
	First and second coats	Masonry	3	3

For SI: 1 inch = 25.4 mm, 1 cubic foot = 0.0283 m³, 1 pound = 0.454 kg.

- Wood-fibered gypsum plaster may be mixed in the proportions of 100 pounds of gypsum to not more than one cubic foot of sand where applied on masonry or concrete.
- When determining the amount of aggregate in set plaster, a tolerance of 10% shall be allowed.
- Combinations of sand and lightweight aggregate may be used, provided the volume and weight relationship of the combined aggregate to gypsum plaster is maintained.
- If used for both first and second coats, the volume of aggregate may be 2.5 cubic feet.
- Where plaster is 1 inch or more in total thickness, the proportions for the second coat may be increased to three cubic feet.

780 CMR TABLE 5702.1(3)
PORTLAND CEMENT PLASTER

MAXIMUM VOLUME AGGREGATE PER VOLUME CEMENTITIOUS MATERIAL ^a					MINIMUM PERIOD MOIST COATS	MINIMUM INTERVAL BETWEEN
Coat	Portland cement plaster ^b maximum volume aggregate per volume cement	Portland cement-lime plaster ^c				
		Maximum volume lime per volume cement	Maximum volume sand per volume cement and lime	Approximate minimum thickness ^d curing (inches)		
First	4	¾	4	¾ ^e	48 Hours ^f	48 Hours ^g
Second	5	¾	5	First and second coats	48 Hours	7 Days ^h
Finished	3 ⁱ	—	3 ⁱ	½	—	Note ^h

For SI: 1 inch = 25.4 mm, 1 pound = 0.454 kg.

- When determining the amount of aggregate in set plaster, a tolerance of 10% may be allowed.
- From ten to 20 pounds of dry hydrated lime (or an equivalent amount of lime putty) may be added as a plasticizing agent to each sack of Type I and Type II standard portland cement in base coat plaster.
- No additions of plasticizing agents shall be made.
- See 780 CMR Table 5702.1(1).
- Measured from face of support or backing to crest of scored plaster.
- 24-hour minimum period for moist curing of interior portland cement plaster.
- 24 hour minimum interval between coats of interior portland cement plaster.
- Finish coat plaster may be applied to interior portland cement base coats after a 48-hour period.
- For finish coat, plaster up to an equal part of dry hydrated lime by weight (or an equivalent volume of lime putty) may be added to Type I, Type II and Type III standard portland cement.

5702.2 Interior Plaster. Gypsum plaster or portland cement plastering materials shall conform to ASTM C 5, C 28, C 35, C 37, C 59, C 61, C 587, C 588, C 631, C 847, C 897, C 933, C 1032 and C 1047, and shall be installed or applied in conformance with ASTM C 843, C 844 and C 1063.

Plaster shall not be less than three coats when applied over metal lath and not less than two coats when applied over other bases permitted by 780 CMR 5702 except that veneer plaster may be applied in one coat not to exceed 3/16 inch (4.76 mm) thickness, provided the total thickness is as set forth in 780 CMR Table 5702.1(1).

5702.2.1 Support. Support spacing for gypsum or metal lath on walls or ceilings shall not exceed 16 inches (406 mm) for 3/8 inch thick (9.5 mm) or 24 inches (610 mm) for 1/2-inch-thick (12.7 mm) plain gypsum lath. Gypsum lath shall be installed at right angles to support framing with end joints in adjacent courses staggered by at least one framing space.

5702.3 Gypsum Board.

5702.3.1 Materials. All gypsum board materials and accessories shall conform to ASTM C 36, C 79, C 475, C 514, C 630, C 931, C 960, C 1002, C 1047, C 1177, C 1178, C 1278, C 1395 or C 1396 and shall be installed in accordance with the provisions of 780CMR 5702. Adhesives for the installation of gypsum board shall conform to ASTM C 557.

5702.3.2 Wood Framing. Wood framing supporting gypsum board shall not be less than two inches (51 mm) nominal thickness in the least

dimension except that wood furring strips not less than one-inch-by-two inch (25.4 mm by 51 mm) nominal dimension may be used over solid backing or framing spaced not more than 24 inches (610mm) on center.

5702.3.3 Steel Framing. Steel framing supporting gypsum board shall not be less than 1.25 inches (32mm) wide in the least dimension. Light-gage nonload-bearing steel framing shall comply with ASTM C 645. Load-bearing steel framing and steel framing from 0.033 inch to 0.112 inch (0.838 mm to 2.84 mm) thick shall comply with ASTM C 955.

5702.3.4 Insulating Concrete Form Walls. Foam plastics for insulating concrete form walls constructed in accordance with 780 CMR 5404.4 and 5611 on the interior of habitable spaces shall be covered in accordance with 780 CMR 5314.1.2. Adhesives are permitted to be used in conjunction with mechanical fasteners. Adhesives used for interior and exterior finishes shall be compatible with the insulating form materials.

5702.3.5 Application. Maximum spacing of supports and the size and spacing of fasteners used to attach gypsum board shall comply with 780 CMR Table 5702.3.5. Gypsum sheathing shall be attached to exterior walls in accordance with 780 CMR Table 5602.3(1). Gypsum board shall be applied at right angles or parallel to framing members. All edges and ends of gypsum board shall occur on the framing members, except those edges and ends that are perpendicular to the framing members. Interior gypsum board shall

not be installed where it is directly exposed to the weather or to water.

5702.3.6 Fastening. Screws for attaching gypsum board to wood framing shall be Type W or Type S in accordance with ASTM C 1002 and shall penetrate the wood not less than $\frac{5}{8}$ inch (15.9 mm). Screws for attaching gypsum board to

light-gage steel framing shall be Type S in accordance with ASTM C 1002 and shall penetrate the steel not less than $\frac{3}{8}$ inch (9.5 mm). Screws for attaching gypsum board to steel framing 0.033 inch to 0.112 inch (0.838 mm to 2.84 mm) thick shall comply with ASTM C 954.

**780 CMR TABLE 5702.3.5
MINIMUM THICKNESS AND APPLICATION OF GYPSUM BOARD**

THICKNESS OF GYPSUM BOARD BOARD (inches)	APPLICATION	ORIENTATION OF GYPSUMBOARD TO FRAMING	MAXIMUM SPACING OF FRAMING MEMBERS (inches o.c.)	MAXIMUM SPACING OF FASTENERS (inches)		SIZE OF NAILS FOR APPLICATION TO WOOD FRAMING ^c
				Nails ^a	Screws ^b	
Application without Adhesive						
3/8	Ceiling ^d	Perpendicular	16	7	12	13 gage, 1¼" long, 19/64" head; 0.098" diameter, 1¼" long, annular-ringed; or 4d cooler nail, 0.080" diameter, 13/16" long, 7/32" head.
	Wall	Either direction	16	8	16	
1/2	Ceiling	Either direction	16	7	12	13 gage, 13/16" long, 19/64" head; 0.098" diameter, 1¼" long, annular-ringed; 5d cooler nail, 0.086" diameter, 15/16" long, 15/64" head; or gypsum board nail, 0.086" diameter, 15/16" long, 9/32" head.
	Ceiling ^d	Perpendicular	24	7	12	
	Wall	Either direction	24	8	12	
	Wall	Either direction	16	8	16	
5/8	Ceiling	Either direction	16	7	12	13 gage, 15/16" long, 19/64" head; 0.098" diameter, 13/16" long, annular-ringed; 6d cooler nail, 0.092" diameter, 17/8" long, ¼" head; or gypsum board nail, 0.0915" diameter, 17/8" long, 19/64" head.
	Ceiling ^e	Perpendicular	24	7	12	
	Wall	Either direction	24	8	12	
	Wall	Either direction	16	8	16	
Application with Adhesive						
3/8	Ceiling ^d	Perpendicular	16	16	16	Same as above for 3/8" gypsum board
	Wall	Either direction	16	16	24	
1/2 or 5/8	Ceiling	Either direction	16	16	16	Same as above for 1/2" and 5/8" gypsum board, respectively
	Ceiling ^d	Perpendicular	24	12	16	
	Wall	Either direction	24	16	24	
Two 3/8 layers	Ceiling	Perpendicular	16	16	16	Base ply nailed as above for 1/2" gypsum board; face ply installed with adhesive
	Wall	Either direction	24	24	24	

For SI: 1 inch = 25.4 mm.

- For application without adhesive, a pair of nails spaced not less than two inches apart or more than $2\frac{1}{2}$ inches apart may be used with the pair of nails spaced 12 inches on center.
- Screws shall be Type S or W per ASTM C 1002 and shall be sufficiently long to penetrate wood framing not less than $\frac{5}{8}$ inch and metal framing not less than $\frac{3}{8}$ inch.
- Where metal framing is used with a clinching design to receive nails by two edges of metal, the nails shall be not less than $\frac{5}{8}$ inch longer than the gypsum board thickness and shall have ringed shanks. Where the metal framing has a nailing groove formed to receive the nails, the nails shall have barbed shanks or be 5d, 13½ gage, $\frac{1}{8}$ inches long, $\frac{15}{64}$ -inch head for $\frac{1}{2}$ -inch gypsum board; and 6d, 13 gage, $\frac{1}{8}$ inches long, $\frac{15}{64}$ -inch head for $\frac{5}{8}$ -inch gypsum board.
- Three-eighths-inch-thick single-ply gypsum board shall not be used on a ceiling where a water-based textured finish is to be applied, or where it will be required to support insulation above a ceiling. On ceiling applications to receive a water-based texture material, either hand or spray applied, the gypsum board shall be applied perpendicular to framing. When applying a water-based texture material, the minimum gypsum board thickness shall be increased from $\frac{3}{8}$ inch to $\frac{1}{2}$ inch for 16-inch on center framing, and from $\frac{1}{2}$ inch to $\frac{5}{8}$ inch for 24-inch on center framing or $\frac{1}{2}$ -inch sag-resistant gypsum ceiling board shall be used.
- Type X gypsum board for garage ceilings beneath habitable rooms shall be installed perpendicular to the ceiling framing and shall be fastened at maximum six inches o.c. by minimum $\frac{1}{8}$ inches 6d coated nails or equivalent drywall screws.

5702.4 Ceramic Tile.

5702.4.1 General. Ceramic tile surfaces shall be installed in accordance with ANSI A108.1, A108.4, A108.5, A108.6, A108.11, A118.1, A118.3, A136.1 and A137.1.

5702.4.2 Gypsum Backer. Gypsum board utilized as the base or backer for adhesive application of ceramic tile or other nonabsorbent finish material shall conform with ASTM C630 or C1178. Water-resistant gypsum backing board shall be permitted to be used on ceilings where framing spacing does not exceed 12 inches (305 mm) on center for ½-inch-thick (12.7 mm) or 16 inches (406 mm) for ⅝ inch-thick (15.9 mm) gypsum board. Water-resistant gypsum board shall not be installed over a vapor retarder in a shower or tub compartment. All cut or exposed edges, including those at wall intersections, shall be sealed as recommended by the manufacturer.

5702.4.3 Limitations. Water-resistant gypsum backing board shall not be used in the following locations:

1. Over a vapor retarder in a shower or bathtub compartment.
2. Where there will be direct exposure to water, or in areas subject to continuous high humidity.

5702.5 Other Finishes. Wood veneer paneling and hardboard paneling shall be placed on wood or cold-formed steel framing spaced not more than 16 inches (406 mm) on center. Wood veneer and hard board paneling less than ¼ inch (6.4 mm) nominal thickness shall not have less than a ⅜-inch (9.5 mm) gypsum board backer. Wood veneer paneling not less than ¼-inch (6.4 mm) nominal thickness shall conform to ANSI/HPVA HP-1. Hardboard paneling shall conform to ANSI/AHA A135.5.

5702.6 Wood Shakes and Shingles. Wood shakes and shingles shall conform to CSSB *Grading Rules for Wood Shakes and Shingles* and shall be permitted to be installed directly to the studs with maximum 24 inches (610 mm) on center spacing.

5702.6.1 Attachment. Nails, staples or glue are permitted for use in attaching shakes or shingles to the wall, and the shakes or shingles shall be permitted to be attached directly to the surface provided the fasteners are appropriate for the type of wall surface material. When nails or staples are used, two fasteners shall be provided and shall be placed so that they are covered by the course above.

5702.6.2 Furring Strips. Where furring strips are used, they shall be one inch by two inches or one inch by three inches (25.4 mm by 51 mm or 25.4 mm by 76 mm), spaced a distance on center equal to the desired exposure, and shall be attached to the wall by nailing through other wall material into the studs.

780 CMR 5703 EXTERIOR COVERING

5703.1 General. Exterior walls shall provide the building with a weather-resistant exterior wall envelope. The exterior wall envelope shall include flashing as described in 780 CMR 5703.8. The exterior wall envelope shall be designed and constructed in such a manner as to prevent the accumulation of water within the wall assembly by providing a water-resistive barrier behind the exterior veneer as required by 780 CMR 5703.2.

5703.2 Weather-resistant Sheathing Paper. Asphalt-saturated felt free from holes and breaks, weighing not less than 14 pounds per 100 square feet (0.683 kg/m²) and complying with ASTM D 226 or other approved weather-resistant material shall be applied over studs or sheathing of all exterior walls as required by 780 CMR Table 5703.4. Such felt or material shall be applied horizontally, with the upper layer lapped over the lower layer not less than two inches (51 mm). Where joints occur, felt shall be lapped not less than six inches (152 mm).

Exception: Such felt or material is permitted to be omitted in the following situations:

1. In detached accessory buildings.
2. Under panel siding with shiplap joints or battens.
3. Under exterior wall finish materials as permitted in 780 CMR Table 5703.4.
4. Under paperbacked stucco lath.

5703.3 Wood, Hardboard and Wood Structural Panel Siding.

5703.3.1 Panel Siding. Joints in wood, hardboard or wood structural panel siding shall be made as follows unless otherwise approved. Vertical joints in panel siding shall occur over framing members, unless wood or wood structural panel sheathing is used, and shall be shiplapped or covered with a batten. Horizontal joints in panel siding shall be lapped a minimum of one inch (25.4 mm) or shall be shiplapped or shall be flashed with Z-flashing and occur over solid blocking, wood or wood structural panel sheathing.

5703.3.2 Horizontal Siding. Horizontal lap siding shall be lapped a minimum of one inch (25.4 mm), or 0.5 inch (12.7 mm) if rabbeted, and shall have the ends caulked, covered with a batten, or sealed and installed over a strip of flashing.

5703.4 Attachments. Unless specified otherwise, all wall coverings shall be securely fastened in accordance with 780 CMR Table 5703.4 or with other approved aluminum, stainless steel, zinc-coated or other approved corrosion-resistive fasteners.

780 CMR TABLE 5703.4

WEATHER-RESISTANT SIDING ATTACHMENT AND MINIMUM THICKNESS

WEATHER-RESISTANT SIDING ATTACHMENT AND MINIMUM THICKNESS										
SIDING MATERIAL		NOMINAL THICKNESS ^a (inches)	JOINT TREATMENT	SHEATHING PAPER REQUIRED	TYPE OF SUPPORTS FOR THE SIDING MATERIAL AND FASTENERS ^{b,c,d}					
					Wood or wood structural panel sheathing	Fiberboard sheathing into stud	Gypsum sheathing into stud	Foam plastic sheathing into stud	Direct to studs	Number or spacing of fasteners
Horizontal aluminum	Without insulation	0.019 ⁱ 0.024	Lap	No	0.120 nail 1½" long	0.120 nail 2" long	0.120 nail 2" long	0.120 nail ²	Not allowed	Same as stud spacing
			Lap	No	0.120 nail 1½" long	0.120 nail 2" long	0.120 nail 2" long	0.120 nail ²	Not allowed	
	With insulation	0.019	Lap	No	0.120 nail 1½" long	0.120 nail 2½" long	0.120 nail 2½" long	0.120 nail ²	0.120 nail 1½" long	
Brick veneer		2	780 CMR 5703	Yes (Note m)	See 780 CMR 5703 and 780 CMR Figure 5703.7 ^h					
Concrete masonry veneer		2								
Hardboard Panel siding-vertical		7/16	Note g	See 780 CMR 5703.2	Note o	Note o	Note o	Note o	Note o	6" panel edges 12" inter. sup. ^p
Hardboard ^l Lap-siding-horizontal		7/16	Note r	Yes	Note q	Note q	Note q	Note q	Note q	Same as stud spacing 2 per bearing
Steel ⁱ		29 ga.	Lap	No	0.113 nail 1¾" Staple-1¾"	0.113 nail 2¾" Staple-2½"	0.113 nail 2½" Staple-2½"	0.11 nail ^x Staple ^z	Not allowed	Same as stud spacing
Stone veneer		2	780CMR 5703	Yes (Note m)	See 780 CMR 5703 and 780 CMR Figure 5703.7 ^h					
Particleboard panels		¾ – ½	Note g	Note g	6d box nail	6d box nail	6d box nail	box nail	6d box nail, ¾ not allowed	6" panel edge 12" inter. sup.
		5/8	Note g	Note g	6d box nail	8d box nail	8d box nail	box nail ²	6d box nail	
Plywood panel ^l (exterior grade)		¾	Note g	Note g	0.099 nail-2"	0.113 nail-2½"	0.099 nail-2"	0.113 nail ²	0.099 nail-2"	6" on edges
Vinyl siding ^a		0.035	Lap	No	0.120 nail 1½" Staple-1¾"	0.120 nail 2" Staple-2½"	0.120 nail 2" Staple - 2½"	0.120 nail ² Staple ^z	Not allowed	Same as stud spacing
Wood ^k Rustic, drop		¾ Min	Lap	No	Fastener penetration into stud-1"				0.113 nail-2½" Staple-2"	Face nailing up to 6" widths, 1 nail per bearing; 8" widths and over, 2 nails
Shiplap		19/32 Average	Lap	No						
Bevel		7/16								
Butt tip		3/16	Lap	No						
Fiber cement panel siding ^s		5/16	Note t	Yes Note y	6d corrosion resistant nail ^u	6d corrosion resistant nail ^u	6d corrosion resistant nail ^u	—	corrosion resistant nail ^v	6" per bearing oc on edges, 12" oc on intermed. studs
Fiber cement lap siding ^s		5/16	Note w	Yes Note y	6d corrosion resistant nail ^u	6d corrosion resistant nail ^u	6d corrosion resistant nail ^u	—	6d corrosion resistant nail ^x	Note ^x

For SI: 1 inch = 25.4 mm.

- Based on stud spacing of 16 inches on center. Where studs are spaced 24 inches, siding shall be applied to sheathing approved for that spacing.
- Nail is a general description and shall be T-head, modified round head, or round head with smooth or deformed shanks.
- Staples shall have a minimum crown width of 7/16-inch outside diameter and be manufactured of minimum No. 16 gage wire.
- Nails or staples shall be aluminum, galvanized, or rust-preventive coated and shall be driven into the studs for fiberboard or gypsum backing.
- Aluminum nails shall be used to attach aluminum siding.
- Aluminum (0.019 inch) shall be unbacked only when the maximum panel width is ten inches and the maximum flat area is eight inches. The tolerance for aluminum siding shall be +0.002 inch of the nominal dimension.
- If boards or panels are applied over sheathing or a weather-resistant membrane, joints need not be treated. Otherwise, vertical joints shall occur at studs and be covered with battens or be lapped.
- All attachments shall be coated with a corrosion-resistant coating.
- Shall be of approved type.

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- j. $\frac{3}{8}$ -inch plywood shall not be applied directly to studs spaced greater than 16 inches on center when long dimension is parallel to studs. $\frac{1}{2}$ -inch plywood shall not be applied directly to studs spaced greater than 24 inches on center. The stud spacing shall not exceed the panel span rating provided by the manufacturer unless the panels are installed with the face grain perpendicular to studs or over sheathing approved for that stud spacing.
- k. Woodboard sidings applied vertically shall be nailed to horizontal nailing strips or blocking set 24 inches on center. Nails shall penetrate 1.5 inches into studs, studs and wood sheathing combined, or blocking. A weather-resistant membrane shall be installed weatherboard fashion under the vertical siding unless the siding boards are lapped or battens are used.
- l. Hardboard siding shall comply with AHA A135.6.
- m. For masonry veneer, a weather-resistant membrane or building paper is not required over water-repellent sheathing materials when a 1-inch air space is provided between the veneer and the sheathing. When the one-inch space is filled with mortar, a weather-resistant membrane or building paper is required over studs or sheathing.
- n. Vinyl siding shall comply with ASTM D 3679.
- o. Minimum shank diameter of 0.092 inch, minimum head diameter of 0.225 inch, and nail length must accommodate sheathing and penetrate framing 1.5 inches.
- p. When used to resist shear forces, the spacing must be four inches at panel edges and eight inches on interior supports.
- q. Minimum shank diameter of 0.099 inch, minimum head diameter of 0.240 inch, and nail length must accommodate sheathing and penetrate framing 1.5 inches.
- r. Vertical end joints shall occur at studs and shall be covered with a joint cover or shall be caulked.
- s. Fiber cement siding shall comply with the requirements of ASTM C 1186.
- t. See 780 CMR 5703.10.1.
- u. Minimum 0.102 inch smooth shank, 0.255 inch round head.
- v. Minimum 0.099 inch smooth shank, 0.250 inch round head.
- w. See 780 CMR 5703.10.2.
- x. Face nailing: 2 nails at each stud. Concealed nailing: one 11 gage $1\frac{1}{2}$ galv. roofing nail (0.37 one inch head diameter, 0.120 inch shank) or 6d galv. box nail at each stud.
- y. See 780 CMR 5703.2, Exceptions.
- z. Minimum nail length must accommodate sheathing and penetrate framing 1.5 inches.

5703.5 Wood Shakes and Shingles. Wood shakes and shingles shall conform to CSSB *Grading Rules for Wood Shakes and Shingles*.

5703.5.1 Application. Wood shakes or shingles shall be applied either single-course or double-course over nominal $\frac{1}{2}$ -inch (12.7 mm) wood-based sheathing or to furring strips over $\frac{1}{2}$ -inch (12.7 mm) nominal nonwood sheathing. A weather-resistant permeable membrane shall be provided over all sheathing, with horizontal overlaps in the membrane of not less than two inches (51 mm) and vertical overlaps of not less than six inches (152 mm). Where furring strips are used, they shall be one inch by three inches or one inch by four inches (25.4 mm by 76 mm or 25.4 mm by 102 mm) and shall be fastened horizontally to the studs with 7d or 8d box nails and shall be spaced a distance on center equal to the actual weather exposure of the shakes or shingles, not to exceed the maximum exposure specified in 780 CMR Table 5703.5.2. The spacing between adjacent shingles to allow for expansion shall not exceed $\frac{1}{4}$ inch (6.4 mm), and between adjacent shakes, it shall not exceed $\frac{1}{2}$ inch (12.7 mm). The offset spacing between joints in adjacent courses shall be a minimum of $1\frac{1}{2}$ inches (38 mm).

5703.5.2 Weather exposure. The maximum weather exposure for shakes and shingles shall not exceed that specified in 780 CMR Table 5703.5.2.

780 CMR TABLE 5703.5.2
MAXIMUM WEATHER EXPOSURE FOR
WOOD SHAKES AND SHINGLES ON
EXTERIOR WALLS^{a,b,c}
 (Dimensions are in inches)

LENGTH	EXPOSURE FOR SINGLE COURSE	EXPOSURE FOR DOUBLE COURSE
Shingles ^a		
16	7 $\frac{1}{2}$	12 ^b
18	8 $\frac{1}{2}$	14 ^c
24	11 $\frac{1}{2}$	16
Shakes ^a		
18	8 $\frac{1}{2}$	14
24	11 $\frac{1}{2}$	18

For SI: 1 inch = 25.4 mm.

- a. Dimensions given are for No. 1 grade.
- b. A maximum ten-inch exposure is permitted for No. 2 grade.
- c. A maximum 11-inch exposure is permitted for No. 2 grade.

5703.5.3 Attachment. Each shake or shingle shall be held in place by two hot-dipped zinc-coated, stainless steel, or aluminum nails or staples. The fasteners shall be long enough to penetrate the sheathing or furring strips by a minimum of $\frac{1}{2}$ inch (12.7 mm) and shall not be overdriven.

5703.5.3.1 Staple Attachment. Staples shall not be less than 16 gage and shall have a crown width of not less than $\frac{7}{16}$ inch (11.1 mm), and the crown of the staples shall be parallel with the butt of the shake or shingle. In single-course application, the fasteners shall be concealed by the course above and shall be driven approximately one inch (25.4 mm) above the butt line of the succeeding course and $\frac{3}{4}$ inch (19.1 mm) from the edge. In double-course applications, the exposed shake or shingle shall be face-nailed with two casing nails, driven approximately two inches (51 mm) above the butt line and $\frac{3}{4}$ inch (19.1 mm) from each edge. In all applications, staples shall be concealed by the course above. With shingles wider than eight inches (203 mm) two additional nails shall be required and shall be nailed approximately one inch (25.4 mm) apart near the center of the shingle.

5703.5.4 Bottom Courses. The bottom courses shall be doubled.

5703.6 Exterior Plaster.

5703.6.1 Lath. All lath and lath attachments shall be of corrosion-resistant materials. Expanded metal or woven wire lath shall be attached with $1\frac{1}{2}$ -inch-long (38 mm), 11 gage nails having a $\frac{7}{16}$ -inch (11.1 mm) head, or $\frac{7}{8}$ -inch-long (22.2 mm), 16 gage staples, spaced at no more than six inches (152 mm), or as otherwise approved.

5703.6.2 Plaster. Plastering with portland cement plaster shall be not less than three coats when applied over metal lath or wire lath and shall be not less than two coats when applied over masonry, concrete or gypsum backing. If the plaster surface is completely covered by veneer or other facing material or is completely concealed, plaster application need be only two coats, provided the total thickness is as set forth in 780 CMR Table 5702.1(1).

On wood-frame construction with an on-grade floor slab system, exterior plaster shall be applied in such a manner as to cover, but not extend below, lath, paper and screed.

The proportion of aggregate to cementitious materials shall be as set forth in 780CMR Table 5702.1(3).

5703.6.2.1 Weep Screeds. A minimum 0.019-inch (0.48 mm) (No. 26 galvanized sheet gage), corrosion-resistant weep screed or plastic weep screed, with a minimum vertical attachment flange of $3\frac{1}{2}$ inches (89 mm) shall be provided at or below the foundation plate line on exterior stud walls in accordance with ASTM C 926. The weep screed shall be placed a minimum of four inches (102 mm) above the earth or two inches (51 mm) above paved areas and shall be of a type that will

allow trapped water to drain to the exterior of the building. The weather-resistant barrier shall lap the attachment flange. The exterior lath shall cover and terminate on the attachment flange of the weep screed.

5703.7 Stone and Masonry Veneer, General. All stone and masonry veneer shall be installed in accordance with 780 CMR 57.00, 780 CMR Table 5703.4 and 780 CMR Figure 5703.7. Such veneers installed over a backing of wood or cold-formed steel shall be limited to *30 feet (9144 mm) in height above the noncombustible foundation, with an additional eight feet (2348 mm) permitted for ends.*

5703.7.1 Interior Veneer Support. Veneers used as interior wall finishes shall be permitted to be supported on wood or cold-formed steel floors that are designed to support the loads imposed.

5703.7.2 Exterior veneer support. *Exterior masonry veneers having an installed weight of 40 pounds per square foot (195 kg/m²) or less shall be permitted to be supported on cold-formed steel construction. When masonry veneer supported by cold-formed steel construction adjoins masonry veneer supported by the foundation, there shall be a movement joint between the veneer supported by the cold-formed steel construction and the veneer supported by the foundation. The wood or cold-formed steel construction supporting the masonry veneer shall be designed to limit the deflection to $\frac{1}{600}$ of the span for the supporting members. The design of the cold-formed steel construction shall consider the weight of the veneer and any other loads.*

5703.7.2.1 Support by Steel Angle: A minimum six inches by four inches by $\frac{5}{16}$ inch (152 mm by 102 mm by eight mm) steel angle, with the long leg placed vertically, shall be anchored to double two inches by four inches (51 mm by 102 mm) wood studs at a maximum on center spacing of 16 inches (406 mm). Anchorage of the steel angle at every double stud spacing shall be a minimum of two $\frac{7}{16}$ inch (11.1 mm) diameter by four inches (102 mm) lag screws. The steel angle shall have a minimum clearance to underlying construction of $\frac{1}{16}$ inch (1.6 mm). A minimum of $\frac{2}{3}$ the width of the masonry veneer thickness shall bear on the steel angle. Flashing and weep holes shall be located in the masonry veneer wythe in accordance with 780 CMR Figure 5703.7.1. The maximum height of masonry veneer above the steel angle support shall be 12 feet, eight inches (3861 mm). The air space separating the masonry veneer from the wood backing shall be in accordance with 780MR 5703.7.4 and 5703.7.4.2. The method of support for the masonry veneer on wood construction shall be constructed in accordance

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with 780 CMR Figure 5703.7.2.1.

The maximum slope of the roof construction without stops shall be 7:12. Roof construction with slopes greater than 7:12 but not more than 12:12 shall have stops of a minimum three inches by three inches by ¼ inch (76 mm by 76 mm by six mm) steel plate welded to the angle at 24 inches (610 mm) on center along the angle or as approved by the building official.

5703.7.2.2 Support by Roof Construction.

A steel angle shall be placed directly on top of the roof construction. The roof supporting construction for the steel angle shall consist of a minimum of three two-inch by six-inch (51 mm by 152 mm) wood members. The wood member abutting the vertical wall stud construction shall be anchored with a minimum of three ⅝-inch (15.9 mm) diameter by five-inch (127 mm) lag screws to every wood stud spacing. Each additional roof member shall be anchored by the use of two 10d nails at every wood stud spacing. A minimum of two-thirds the width of the masonry veneer thickness shall bear on the steel angle. Flashing and weep holes shall be located in the masonry veneer wythe in accordance with 780 CMR Figure 5703.7.1. The maximum height of the masonry veneer above the steel angle support shall be 12 feet, eight inches (3861 mm). The air space separating the masonry veneer from the wood backing shall be in accordance with 780 CMR 5703.7.4 and 5703.7.4.2. The method of support for the masonry veneer on wood construction shall be constructed in accordance with 780 CMR Figure 5703.7.2.2.

The maximum slope of the roof construction without stops shall be 7:12. Roof construction with slopes greater than 7:12 but not more than 12:12 shall have stops of a minimum three inches by three inches by ¼ inch (76 mm by 76 mm by six mm) steel plate welded to the angle at 24 inches (610 mm) on center along the angle or as approved by the building official.

5703.7.3 Lintels. Masonry veneer shall not support any vertical load other than the dead load of the veneer above. Veneer above openings shall be supported on lintels of non-combustible materials and the allowable span shall not exceed the values set forth in 780 CMR Table 5703.7.3. The lintels shall have a length of bearing of not less than four inches (102 mm).

5703.7.4 Anchorage. Masonry veneer shall be anchored to the supporting wall with corrosion-resistant metal ties. Where veneer is anchored to wood backings through the use of corrugated sheet metal ties, the distance separating the veneer from the sheathing material shall be a maximum of one inch (25.4 mm). Where the veneer is anchored to wood backings through the use of metal strand wire ties, the distance separating the veneer from the sheathing material shall be a maximum of 4½ inches (114 mm). Where the veneer is anchored to cold-formed steel backings, adjustable metal strand wire ties shall be used. Where veneer is anchored to cold-formed steel backings, the distance separating the veneer from the sheathing material shall be a maximum of 4½ inches (114 mm).

**780 CMR TABLE 5703.7.3
ALLOWABLE SPANS FOR LINTELS SUPPORTING MASONRY VENEER^{a,b,c}**

SIZE OF STEEL ANGLE ^{a,c} (inches)	NO STORY ABOVE	ONE STORY ABOVE	TWO STORIES ABOVE	NO. OF ½" OR EQUIVALENT REINFORCING BARS ^c
3 x 3 x ¼	6'-0"	4'-6"	3'-0"	1
4 x 3 x ¼	8'-0"	6'-0"	4'-6"	1
5 x 3½ x ⅝ ₁₆	10'-0"	8'-0"	6'-0"	2
6 x 3½ x ⅝ ₁₆	14'-0"	9'-6"	7'-0"	2
2-6 x 3½ x ⅝ ₁₆	20'-0"	12'-0"	9'-6"	4

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

- Long leg of the angle shall be placed in a vertical position.
- Depth of reinforced lintels shall not be less than eight inches and all cells of hollow masonry lintels shall be grouted solid. Reinforcing bars shall extend not less than eight inches into the support.
- Steel members indicated are adequate typical examples; other steel members meeting structural design requirements may be used.

5703.7.4.1 Size and Spacing. Veneer ties, if strand wire, shall not be less in thickness than No. 9 U.S. gage wire and shall have a hood embedded in the mortar joint, or if sheet metal, shall be not less than No.22 U.S. gage by $\frac{7}{8}$ inch (22.3 mm) corrugated. Each tie shall be spaced not more than 24 inches (610 mm) on center horizontally and vertically and shall support not more than 2.67 square feet (0.248 m²) of wall area.

Exception: In wind areas of more than 30 pounds per square foot pressure (1.44 kN/m²), each tie shall support not more than two square feet (0.186 m²) of wall area.

5703.7.4.1.1 Veneer Ties Around Wall Openings. Additional metal ties shall be provided around all wall openings greater than 16 inches (406 mm) in either dimension. Metal ties around the perimeter of openings shall be spaced not more than 3 feet (914 mm) on center and placed within 12 inches (305 mm) of the wall opening.

5703.7.4.2 Air Space. The veneer shall be separated from the sheathing by an air space of a minimum of one inch (25.4 mm) but not more than 4.5 inches (114 mm). The weather-resistant membrane or asphalt-saturated felt required by 780 CMR 5703.2 is not required over water-repellent sheathing materials.

5703.7.4.3 Mortar or Grout Fill. As an alternate to the air space required by 780 CMR 5703.7.4.2, mortar or grout shall be permitted to fill the air space. When the one-inch (25.4mm) space is filled with mortar, a weather-resistant membrane or building paper is required over studs or sheathing. When filling the air space, it is permitted to replace the sheathing and weather-resistant membrane or asphalt-saturated felt paper with a wire mesh and approved paper or an approved paper-backed reinforcement attached directly to the studs.

5703.7.5 Flashing. Flashing shall be located beneath the first course of masonry above finished ground level above the foundation wall or slab and at other points of support, including structural floors, shelf angles and lintels when masonry veneers are designed in accordance with 780 CMR 5703.7. See 780 CMR 5703.8 for additional requirements.

5703.7.6 Weepholes. Weepholes shall be provided in the outside wythe of masonry walls at a maximum spacing of 33 inches (838 mm) on center. Weepholes shall not be less than $\frac{3}{16}$ inch (4.8 mm) in diameter. Weepholes shall be located immediately above the flashing.

5703.8 Flashing. Approved corrosion-resistive

flashing shall be provided in the exterior wall envelope in such a manner as to prevent entry of water into the wall cavity or penetration of water to the building structural framing components. The flashing shall extend to the surface of the exterior wall finish and shall be installed to prevent water from reentering the exterior wall envelope. Approved corrosion-resistive flashings shall be installed at all of the following locations:

1. At top of all exterior window and door openings in such a manner as to be leakproof, except that self-flashing windows having a continuous lap of not less than 1 $\frac{1}{8}$ inches (28 mm) over the sheathing material around the perimeter of the opening, including corners, do not require additional flashing; jamb flashing may also be omitted when specifically approved by the building official.
2. At the intersection of chimneys or other masonry construction with frame or stucco walls, with projecting lips on both sides under stucco copings.
3. Under and at the ends of masonry, wood or metal copings and sills.
4. Continuously above all projecting wood trim.
5. Where exterior porches, decks or stairs attach to a wall or floor assembly of wood-frame construction.
6. At wall and roof intersections.
7. At built-in gutters.

5703.9 Exterior Insulation Finish Systems, General. All Exterior Insulation Finish Systems (EIFS) shall be installed in accordance with the manufacturer's installation instructions and the requirements of 780 CMR 5703.9. Decorative trim shall not be face nailed through the EIFS. The EIFS shall terminate not less than six inches (152 mm) above the finished ground level.

5703.9.1 Weather-resistive Barrier. All EIFS shall have a weather-resistive barrier applied between the underlying water-sensitive building components and the exterior insulation, and a means of draining water to the exterior of the veneer. A weather-resistive barrier shall be compliant with ASTM D 226 Type I asphalt saturated felt or equivalent, shall be applied horizontally with the upper layer lapped over the lower layer not less than two inches (51 mm), and shall have all vertical joints lapped not less than six inches (152 mm).

5703.9.2 Flashing, General. Flashing of EIFS shall be provided in accordance with the requirements of 780 CMR 5703.8.

5703.10 Fiber Cement Siding.

5703.10.1 Panel Siding. Panels shall be installed with the long dimension parallel to framing. Vertical joints shall occur over framing members

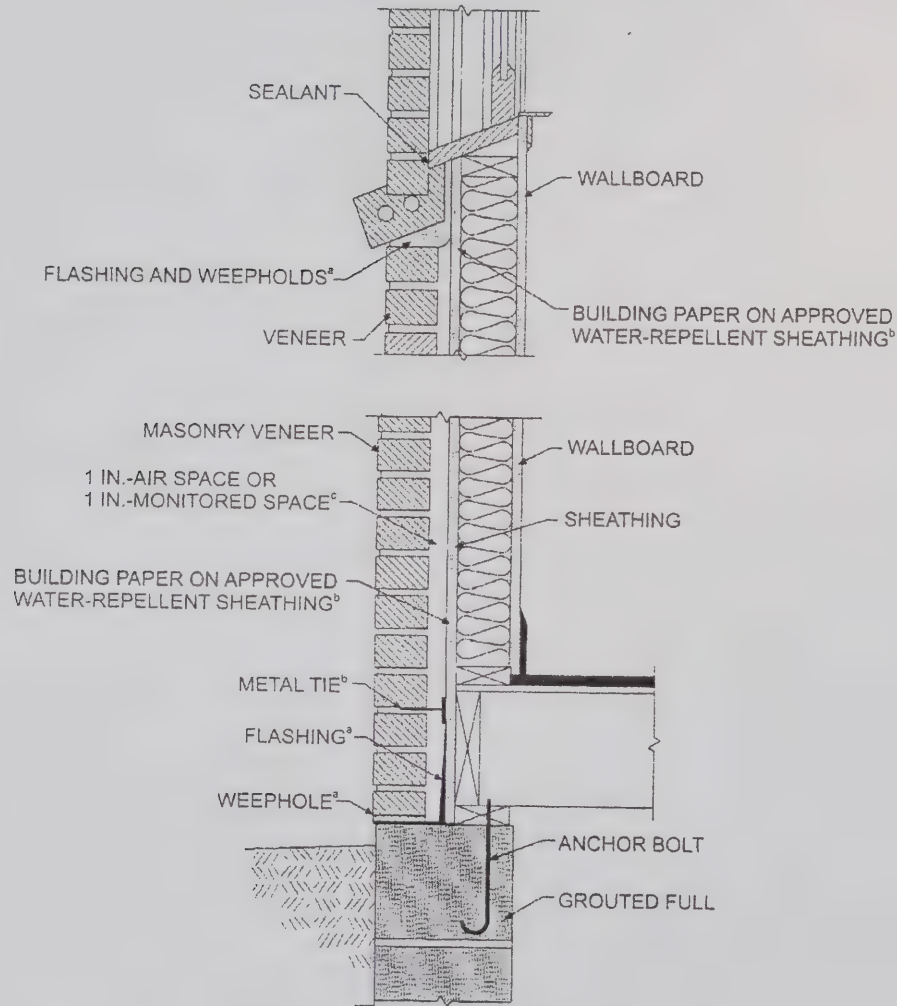
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and shall be sealed with caulking or covered with battens. Horizontal joints shall be flashed with Z-flashing and blocked with solid wood framing.

5703.10.2 Horizontal Lap Siding. Lap siding shall be lapped a minimum of 1¼ inches and shall have the ends sealed with caulking, covered with

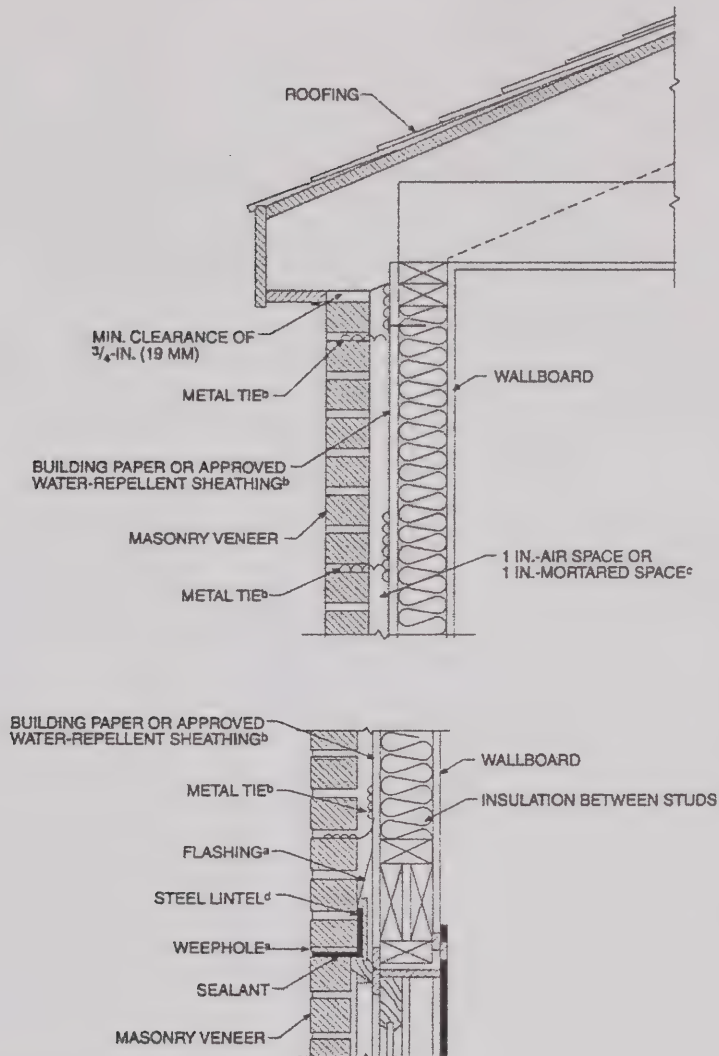
an H-section joint cover, or located over a strip of flashing. Lap siding courses may be installed with the fastener heads exposed or concealed, according to approved manufacturers' installation instructions.

**780 CMR FIGURE 5703.7
MASONRY VENEER WALL DETAILS**



For SI: 1 inch = 25.4 mm.

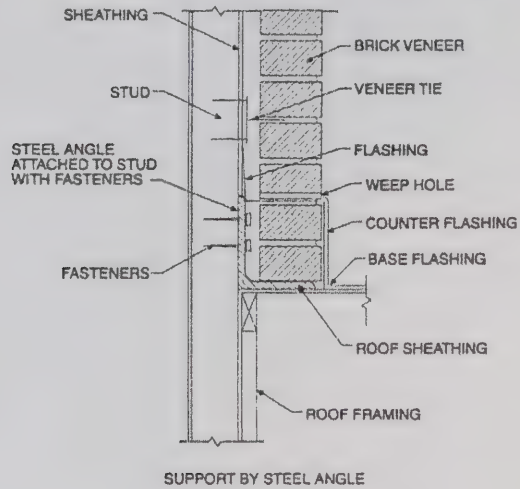
780 CMR FIGURE 5703.7—continued
MASONRY VENEER WALL DETAILS



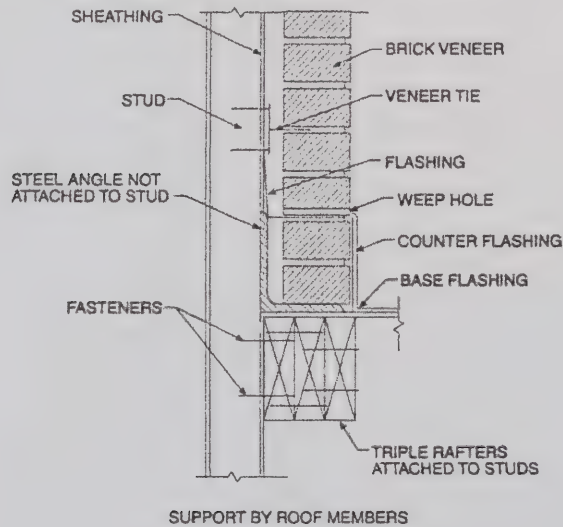
For SI: 1 inch = 25.4 mm.

- a. See 780 CMR 5703.7.5, 5703.7.6 and 5703.8.
- b. See 780 CMR 5703.2 and 5703.7.4.
- c. See 780 CMR 5703.7.4.2 and 5703.7.4.3.
- d. See 780 CMR 5703.7.2.1.

780 CMR FIGURE 5703.7.2.1
EXTERIOR MASONRY VENEER SUPPORT BY STEEL ANGLES



780 CMR FIGURE 5703.7.2.2
EXTERIOR MASONRY VENEER SUPPORT BY ROOF MEMBERS



ROOF-CEILING CONSTRUCTION

780 CMR 5801 GENERAL

5801.1 Application. The provisions of 780 CMR 56.00 shall control the design and construction of the roof-ceiling system for all *one- and two-family detached dwellings and accessory buildings*.

5801.2 Requirements. Roof and ceiling construction shall be capable of accommodating all loads imposed according to 780 CMR 5301 and of transmitting the resulting loads to the supporting structural elements.

5801.3 Roof Drainage. In areas where expansive or collapsible soils are known to exist, all dwellings shall have a controlled method of water disposal from roofs that will collect and discharge all roof drainage to the ground surface at least five feet (1524 mm) from foundation walls or to an approved drainage system.

780 CMR 5802 WOOD ROOF FRAMING

5802.1 Identification. Load-bearing dimension lumber for rafters, trusses and ceiling joists shall be identified by a grade mark of a lumber grading or inspection agency that has been approved by an accreditation body that complies with DOC PS 20. In lieu of a grade mark, a certificate of inspection issued by a lumber grading or inspection agency meeting the requirements of 780 CMR 5802 shall be accepted.

5802.1.1 Blocking. Blocking shall be a minimum of utility grade lumber.

5802.1.2 End-jointed Lumber. Approved end-jointed lumber identified by a grade mark conforming to 780 CMR 5802.1 may be used interchangeably with solid-sawn members of the same species and grade.

5802.1.3 Fire-retardant-treated Wood. Fire-retardant-treated wood (*FRTW*) is any wood product which, when impregnated with chemicals by a pressure process or other means during manufacture, shall have, when tested in accordance with ASTM E84, a listed flame spread index of 25 or less and show no evidence of significant progressive combustion when the test is continued for an additional 20-minute period. In addition, the flame front shall not progress more than 10.5 feet (3200 mm) beyond the center line of the burners at any time during the test.

5802.1.3.1 Labeling. Fire-retardant-treated lumber and wood structural panels shall be labeled. The label shall contain:

1. The identification mark of an approved agency.

2. Identification of the treating manufacturer.
3. The name of the fire-retardant treatment.
4. The species of wood treated.
5. Flame spread and smoke developed rating.
6. Method drying after treatment.
7. Conformance with appropriate standards in accordance with 780 CMR 5802.1.3.2 through 5802.1.3.5.
8. For FRTW exposed to weather, damp or wet location, the words "No increase in the listed classification when subjected to the Standard Rain Test" (ASTM D2898).

5802.1.3.2 Strength Adjustments. Design values for untreated lumber and wood structural panels as specified in 780 CMR 5802.1, shall be adjusted for fire retardant-treated wood. Adjustments to design values shall be based upon an approved method of investigation which takes into consideration the effects of the anticipated temperature and humidity to which the fire-retardant-treated wood will be subjected, the type of treatment and redrying procedures.

5802.1.3.2.1 Wood Structural Panels. The effect of treatment and the method of redrying after treatment, and exposure to high temperatures and high humidities on the flexure properties of fire-retardant-treated softwood plywood shall be determined in accordance with ASTM D 5516. The test data developed by ASTM D 5516 shall be used to develop adjustment factors, maximum loads and spans, or both for untreated plywood design values in accordance with ASTM D 6305. Each manufacturer shall publish the allowable maximum loads and spans for service as floor and roof sheathing for their treatment.

5802.1.3.2.2 Lumber. For each species of wood treated the effect of the treatment and the method of redrying after treatment and exposure to high temperatures and high humidities on the allowable design properties of fire-retardant-treated lumber shall be determined in accordance with ASTM D 5664. The test data developed by ASTM D 5664 shall be used to develop modification factors for use at or near room temperature and at elevated temperatures and humidity in accordance with an approved method of investigation. Each manufacturer shall publish the modification factors for service at temperatures of not less

than 80°F (26.7°C) and for roof framing. The roof framing modification factors shall take into consideration the climatological location.

5802.1.3.3 Exposure to Weather. Where fire-retardant-treated wood is exposed to weather, or damp or wet locations, it shall be identified as "Exterior" to indicate there is no increase in the listed flamespread index as defined in 780 CMR 5802.1.3 when subjected to ASTM D 2898.

5802.1.3.4 Interior Applications. Interior fire-retardant-treated wood shall have a moisture content of not over 28% when tested in accordance with ASTM D 3201 procedures at 92% relative humidity. Interior fire-retardant-treated wood shall be tested in accordance with 780 CMR 5802.1.3.2.1 or 5802.1.3.2.2. Interior fire-retardant-treated wood designated as Type A shall be tested in accordance with the provisions of 780 CMR 5802.

5802.1.3.5 Moisture Content. Fire-retardant-treated wood shall be dried to a moisture content of 19% or less for lumber and 15% or less for wood structural panels before use. For wood kiln dried after treatment (KDAT) the kiln temperatures shall not exceed those used in kiln drying the lumber and plywood submitted for the tests described in 780 CMR 5802.1.3.2.1 for plywood and 5802.1.3.2.2 for lumber.

5802.1.4 Structural Glued Laminated Timbers. Glued laminated timbers shall be manufactured and identified as required in AITC A190.1 and ASTM D3737.

5802.2 Design and Construction. Roof-ceilings shall be designed and constructed in accordance with the provisions of 780 CMR 56.00 and 780 CMR Figure 5606.10(1) or in accordance with AFPA/NDS. Components of roof-ceilings shall be fastened in accordance with 780 CMR Table 5602.3(1).

5802.3 Framing Details. Rafters shall be framed to ridge board or to each other with a gusset plate as a tie. Ridge board shall be at least one-inch (25.4 mm) nominal thickness and not less in depth than the cut end of the rafter. At all valleys and hips there shall be a valley or hip rafter not less than two-inch (51 mm) nominal thickness and not less in depth than the cut end of the rafter. Hip and valley rafters shall be supported at the ridge by a brace to a bearing partition or be designed to carry and distribute the specific load at that point. Where the roof pitch is less than three units vertical in 12 units horizontal (25% slope), structural members that support rafters and ceiling joists, such as ridge beams, hips and valleys, shall be designed as beams.

5802.3.1 Ceiling Joist and Rafter Connections. Ceiling joists and rafters shall be nailed to each other in accordance with 780 CMR Tables 5602.3(1) and 5802.5.1(9), and the assembly shall be nailed to the top wall plate in accordance with 780 CMR Table 5602.3(1). Ceiling joists shall be continuous or securely joined where they meet over interior partitions and nailed to adjacent rafters to provide a continuous tie across the building when such joists are parallel to the rafters.

Where ceiling joists are not parallel to rafters, subflooring or metal straps attached to the ends of the rafters shall be installed in a manner to provide a continuous tie across the building, or rafters shall be tied to one-inch by four-inch (25.4 mm by 102 mm) (nominal) minimum-size crossties. The connections shall be in accordance with 780 CMR Table 5602.3(1) or connections of equivalent capacities shall be provided. Where ceiling joists or rafter ties are not provided at the top plate, the ridge formed by these rafters shall also be supported by a girder designed in accordance with accepted engineering practice.

Rafter ties shall be spaced not more than four feet (1219 mm) on center.

5802.3.2 Ceiling Joists Lapped. Ends of ceiling joists shall be lapped a minimum of three inches (76 mm) or butted over bearing partitions or beams and toenailed to the bearing member. When ceiling joists are used to provide resistance to rafter thrust, lapped joists shall be nailed together in accordance with 780 CMR Table 5602.3(1) and butted joists shall be tied together in a manner to resist such thrust.

5802.4 Allowable Ceiling Joist Spans. Spans for ceiling joists shall be in accordance with 780 CMR Tables 5802.4(1) and 5802.4(2). For other grades and species and for other loading conditions, refer to the AF&PA Span Tables for Joists and Rafters, or the AF&PA Maximum Span Calculator for Joists and Rafters.

5802.5 Allowable Rafter Spans. Spans for rafters shall be in accordance with 780 CMR Tables 5802.5.1(1) through 5802.5.1(8). For other grades and species and for other loading conditions, refer to the AF&PA Span Tables for Joists and Rafters, or the AF&PA Maximum Span Calculator for Joists and Rafters. The span of each rafter shall be measured along the horizontal projection of the rafter.

5802.5.1 Purlins. Purlins are permitted to be installed to reduce the span of rafters as shown in 780 CMR Figure 5802.5.1. Purlins shall be sized no less than the required size of the rafters that they support. Purlins shall be continuous and shall be supported by two-inch by four-inch (51 mm by 102 mm) braces installed to bearing walls at a slope not less than 45 degrees from the

horizontal. The braces shall be spaced not more than four feet (1219 mm) on center and the unbraced length of braces shall not exceed eight feet (2438 mm).

5802.6 Bearing. The ends of each rafter or ceiling joist shall have not less than 1½ inches (38 mm) of bearing on wood or metal and not less than three inches (76 mm) on masonry or concrete.

5802.6.1 Finished Ceiling Material. If the finished ceiling material is installed on the ceiling prior to the attachment of the ceiling to the walls, such as in construction at a factory, a compression strip of the same thickness as the finish ceiling material shall be installed directly above the top plate of bearing walls if the compressive strength of the finish ceiling material is less than the loads it will be required to withstand. The compression strip shall cover the entire length of such top plate and shall be at least ½ the width of the top plate. It shall be of material capable of transmitting the loads transferred through it.

5802.7 Cutting and Notching. Structural roof members shall not be cut, bored or notched in excess of the limitations specified in 780 CMR 5802.7.

5802.7.1 Sawn Lumber. Notches in solid lumber joists, rafters and beams shall not exceed 1/6 of the depth of the member, shall not be longer than 1/3 of the depth of the member and shall not be located in the middle 1/3 of the span. Notches at the ends of the member shall not exceed 1/4 the depth of the member. The tension side of members four inches (102 mm) or greater in nominal thickness shall not be notched except at the ends of the members. The diameter of the holes bored or cut into members shall not exceed 1/3 the depth of the member. Holes shall not be closer than two inches (51 mm) to the top or bottom of the member, or to any other hole located in the member. Where the member is also notched, the hole shall not be closer than two inches (51 mm) to the notch.

Exception: Notches on cantilevered portions of rafters are permitted provided the dimension of the remaining portion of the rafter is not less than four-inch nominal (102 mm) and the length of the cantilever does not exceed 24 inches (610 mm).

5802.7.2 Engineered Wood Products. Cuts, notches and holes bored in laminated veneer lumber, glue-laminated members or I-joists are not permitted unless the effect of such penetrations are specifically considered in the design of the member.

5802.8 Lateral Support. Rafters and ceiling joists having a depth-to-thickness ratio exceeding five to one based on nominal dimensions shall be provided with lateral support at points of bearing to prevent rotation.

5802.8.1 Bridging. Rafters and ceiling joists having a depth-to-thickness ratio exceeding six to one based on nominal dimensions shall be supported laterally by solid blocking, diagonal bridging (wood or metal) or a continuous one-inch by three-inch (25.4 mm by 76 mm) wood strip nailed across the rafters or ceiling joists at intervals not exceeding eight feet (2438 mm).

5802.9 Framing of Openings. Openings in roof and ceiling framing shall be framed with header and trimmer joists. When the header joist span does not exceed four feet (1219 mm), the header joist may be a single member the same size as the ceiling joist or rafter. Single trimmer joists may be used to carry a single header joist that is located within three feet (914 mm) of the trimmer joist bearing. When the header joist span exceeds four feet (1219 mm), the trimmer joists and the header joist shall be doubled and of sufficient cross section to support the ceiling joists or rafter framing into the header. Approved hangers shall be used for the header joist to trimmer joist connections when the header joist span exceeds six feet (1829 mm). Tail joists over 12 feet (3658 mm) long shall be supported at the header by framing anchors or on ledger strips not less than two inches by two inches (51 mm by 51 mm).

5802.10 Wood Trusses.

5802.10.1 Truss Design Drawings. Truss design drawings, prepared in conformance with 780 CMR 5802.10.1, shall be provided to the building official and approved prior to installation. Truss design drawings shall include, at a minimum, the information specified below. Truss design drawing shall be provided with the shipment of trusses delivered to the jobsite.

1. Slope or depth, span and spacing.
2. Location of all joints.
3. Required bearing widths.
4. Design loads as applicable.
 - 4.1. Top chord live load (including snow loads).
 - 4.2. Top chord dead load.
 - 4.3. Bottom chord live load.
 - 4.4. Bottom chord dead load.
 - 4.5. Concentrated loads and their points of application.
 - 4.6. Controlling wind loads.
5. Adjustments to lumber and joint connector design values for conditions of use.
6. Each reaction force and direction.
7. Joint connector type and description (e.g., size, thickness or gauge) and the dimensioned location of each joint connector except where symmetrically located relative to the joint interface.
8. Lumber size, species and grade for each member.
9. Connection requirements for:

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- 9.1. Truss to truss girder.
- 9.2. Truss ply to ply.
- 9.3. Field splices.
10. Calculated deflection ratio and/or maximum description for live and total load.
11. Maximum axial compression forces in the truss members to enable the building designer to design the size, connections and anchorage of the permanent continuous lateral bracing. Forces shall be shown on the truss design drawing or on supplemental documents.
12. Required permanent truss member bracing location.

5802.10.2 Design. Wood trusses shall be designed in accordance with accepted engineering practice. The design and manufacture of metal plate connected wood trusses shall comply with ANSI/TPI 1. The truss design drawings shall be prepared by a *Massachusetts-registered architect or registered professional engineer*.

5802.10.3 Bracing. Trusses shall be braced to prevent rotation and provide lateral stability in accordance with the requirements specified in the construction documents for the building and on the individual truss design drawings. In the absence of specific bracing requirements, trusses shall be braced in accordance with Building Component Safety Information (BCSI 1-03) *Guide to Good Practice for Handling, Installing & Bracing of Metal Plate Connected Wood Trusses*.

5802.10.4 Alterations to trusses. Truss members shall not be cut, notched, drilled, spliced or otherwise altered in any way without the approval of a registered design professional. Alterations resulting in the addition of load (e.g., HVAC equipment, water heater) that exceeds the design load for the truss shall not be permitted without verification that the truss is capable of supporting such additional loading.

780 CMR TABLE 5802.4(1)

CEILING JOIST SPANS FOR COMMON LUMBER SPECIES

Uninhabitable attics without storage, live load = 10 psf, $L/\Delta = 240$

CEILING JOIST SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 5 psf			
			2 × 4	2 × 6	2 × 8	2 × 10
			Maximum ceiling joist spans			
			(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)
12	Douglas fir-larch	SS	13-2	20-8	Note a	Note a
	Douglas fir-larch	#1	12-8	19-11	Note a	Note a
	Douglas fir-larch	#2	12-5	19-6	25-8	Note a
	Douglas fir-larch	#3	10-10	15-10	20-1	24-6
	Hem-fir	SS	12-5	19-6	25-8	Note a
	Hem-fir	#1	12-2	19-1	25-2	Note a
	Hem-fir	#2	11-7	18-2	24-0	Note a
	Hem-fir	#3	10-10	15-10	20-1	24-6
	Southern pine	SS	12-11	20-3	Note a	Note a
	Southern pine	#1	12-8	19-11	Note a	Note a
	Southern pine	#2	12-5	19-6	25-8	Note a
	Southern pine	#3	11-6	17-0	21-8	25-7
	Spruce-pine-fir	SS	12-2	19-1	25-2	Note a
	Spruce-pine-fir	#1	11-10	18-8	24-7	Note a
	Spruce-pine-fir	#2	11-10	18-8	24-7	Note a
	Spruce-pine-fir	#3	10-10	15-10	20-1	24-6
16	Douglas fir-larch	SS	11-11	18-9	24-8	Note a
	Douglas fir-larch	#1	11-6	18-1	23-10	Note a
	Douglas fir-larch	#2	11-3	17-8	23-0	Note a
	Douglas fir-larch	#3	9-5	13-9	17-5	21-3
	Hem-fir	SS	11-3	17-8	23-4	Note a
	Hem-fir	#1	11-0	17-4	22-10	Note a
	Hem-fir	#2	10-6	16-6	21-9	Note a
	Hem-fir	#3	9-5	13-9	17-5	21-3
	Southern pine	SS	11-9	18-5	24-3	Note a
	Southern pine	#1	11-6	18-1	23-1	Note a
	Southern pine	#2	11-3	17-8	23-4	Note a
	Southern pine	#3	10-0	14-9	18-9	22-2
	Spruce-pine-fir	SS	11-0	17-4	22-10	Note a
	Spruce-pine-fir	#1	10-9	16-11	22-4	Note a
	Spruce-pine-fir	#2	10-9	16-11	22-4	Note a
	Spruce-pine-fir	#3	9-5	13-9	17-5	21-3
19.2	Douglas fir-larch	SS	11-3	17-8	23-3	Note a
	Douglas fir-larch	#1	10-10	17-0	22-5	Note a
	Douglas fir-larch	#2	10-7	16-7	21-0	25-8
	Douglas fir-larch	#3	8-7	12-6	15-10	19-5
	Hem-fir	SS	10-7	16-8	21-11	Note a
	Hem-fir	#1	10-4	16-4	21-6	Note a
	Hem-fir	#2	9-11	15-7	20-6	25-3
	Hem-fir	#3	8-7	12-6	15-10	19-5
	Southern -pine	SS	11-0	17-4	22-10	Note a
	Southern pine	#1	10-10	17-0	22-5	Note a
	Southern pine	#2	10-7	16-8	21-11	Note a
	Southern pine	#3	9-1	13-6	17-2	20-3
	Spruce-pine-fir	SS	10-4	16-4	21-6	Note a
	Spruce-pine-fir	#1	10-2	15-11	21-0	25-8
	Spruce-pine-fir	#2	10-2	15-11	21-0	25-8
	Spruce-pine-fir	#3	8-7	12-6	15-10	19-5

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780 CMR TABLE 5802.4(1) - continued
CEILING JOIST SPANS FOR COMMON LUMBER SPECIES
 Uninhabitable attics without storage, live load = 10 psf, $L/\Delta = 240$)

CEILING JOIST SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 5 psf			
			2 × 4	2 × 6	2 × 8	2 × 10
			Maximum ceiling joist spans			
			(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)
24	Douglas fir-larch	SS	10-5	16-4	21-7	Note a
	Douglas fir-larch	#1	10-10	15-9	20-1	24-6
	Douglas fir-larch	#2	9-10	14-10	18-9	22-11
	Douglas fir-larch	#3	7-8	11-2	14-2	17-4
	Hem-fir	SS	9-10	15-6	20-5	Note a
	Hem-fir	#1	9-8	15-2	19-7	23-11
	Hem-fir	#2	9-2	14-5	18-6	22-7
	Hem-fir	#3	7-8	11-2	14-2	17-4
	Southern pine	SS	10-3	16-1	21-2	Note a
	Southern pine	#1	10-0	15-9	20-10	Note a
	Southern pine	#2	9-10	15-6	20-1	23-11
	Southern pine	#3	8-2	12-0	15-4	18-1
	Spruce-pine-fir	SS	9-8	15-2	19-11	25-5
	Spruce-pine-fir	#1	9-5	14-9	18-9	22-11
	Spruce-pine-fir	#2	9-5	14-9	18-9	22-11
	Spruce-pine-fir	#3	7-8	11-2	14-2	17-4

Check sources for availability of lumber in lengths greater than 20 feet.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kN/m².

a. Span exceeds 26 feet in length.

780 CMR TABLE 5802.4(2)
CEILING JOIST SPANS FOR COMMON LUMBER SPECIES
(Uninhabitable attics with limited storage, live load = 20 psf, $L/\Delta = 240$)

CEILING JOIST SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf			
			2 x 4	2 x 6	2 x 8	2 x 10
			Maximum ceiling joist spans			
			(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)
12	Douglas fir-larch	SS	10-5	16-4	21-7	Note a
	Douglas fir-larch	#1	10-0	15-9	20-1	24-6
	Douglas fir-larch	#2	9-10	14-10	18-9	22-11
	Douglas fir-larch	#3	7-8	11-2	14-2	17-4
	Hem-fir	SS	9-10	15-6	20-5	Note a
	Hem-fir	#1	9-8	15-2	19-7	23-11
	Hem-fir	#2	9-2	14-5	18-6	22-7
	Hem-fir	#3	7-8	11-2	14-2	17-4
	Southern pine	SS	10-3	16-1	21-2	Note a
	Southern pine	#1	10-0	15-9	20-10	Note a
	Southern pine	#2	9-10	15-6	20-1	23-11
	Southern pine	#3	8-2	12-0	15-4	18-1
	Spruce-pine-fir	SS	9-8	15-2	19-11	25-5
	Spruce-pine-fir	#1	9-5	14-9	18-9	22-11
	Spruce-pine-fir	#2	9-5	14-9	18-9	22-11
	Spruce-pine-fir	#3	7-8	11-2	14-2	17-4
16	Douglas fir-larch	SS	9-6	14-11	19-7	25-0
	Douglas fir-larch	#1	9-1	13-9	17-5	21-3
	Douglas fir-larch	#2	8-9	12-10	16-3	19-10
	Douglas fir-larch	#3	6-8	9-8	12-4	15-0
	Hem-fir	SS	8-11	14-1	18-6	23-8
	Hem-fir	#1	8-9	13-5	16-10	20-8
	Hem-fir	#2	8-4	12-8	16-0	19-7
	Hem-fir	#3	6-8	9-8	12-4	15-0
	Southern pine	SS	9-4	14-7	19-3	24-7
	Southern pine	#1	9-1	14-4	18-11	23-1
	Southern pine	#2	8-11	13-6	17-5	20-9
	Southern pine	#3	7-1	10-5	13-3	15-8
	Spruce-pine-fir	SS	8-9	13-9	18-1	23-1
	Spruce-pine-fir	#1	8-7	12-10	16-3	19-10
	Spruce-pine-fir	#2	8-7	12-10	16-3	19-10
	Spruce-pine-fir	#3	6-8	9-8	12-4	15-0
19.2	Douglas fir-larch	SS	8-11	14-0	18-5	23-4
	Douglas fir-larch	#1	8-7	12-6	15-10	19-5
	Douglas fir-larch	#2	8-0	11-9	14-10	18-2
	Douglas fir-larch	#3	6-1	8-10	11-3	13-8
	Hem-fir	SS	8-5	13-3	17-5	22-3
	Hem-fir	#1	8-3	12-3	15-6	18-11
	Hem-fir	#2	7-10	11-7	14-8	17-10
	Hem-fir	#3	6-1	8-10	11-3	13-8
	Southern pine	SS	8-9	13-9	18-1	23-1
	Southern pine	#1	8-7	13-6	17-9	21-1
	Southern pine	#2	8-5	12-3	15-10	18-11
	Southern pine	#3	6-5	9-6	12-1	14-4
	Spruce-pine-fir	SS	8-3	12-11	17-1	21-8
	Spruce-pine-fir	#1	8-0	11-9	14-10	18-2
	Spruce-pine-fir	#2	8-0	11-9	14-10	18-2
	Spruce-pine-fir	#3	6-1	8-10	11-3	13-8

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780 CMR TABLE 5802.4(2) - continued
CEILING JOIST SPANS FOR COMMON LUMBER SPECIES
(Uninhabitable attics with limited storage, live load = 20 psf, $L/\Delta = 240$)

CEILING JOIST SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf			
			2 × 4	2 × 6	2 × 8	2 × 10
			Maximum ceiling joist spans			
			(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)
24	Douglas fir-larch	SS	8-3	13-0	17-1	20-11
	Douglas fir-larch	#1	7-8	11-2	14-2	17-4
	Douglas fir-larch	#2	7-2	10-6	13-3	16-3
	Douglas fir-larch	#3	5-5	7-11	10-0	12-3
	Hem-fir	SS	7-10	12-3	16-2	20-6
	Hem-fir	#1	7-6	10-11	13-10	16-11
	Hem-fir	#2	7-1	10-4	13-1	16-0
	Hem-fir	#3	5-5	7-11	10-0	12-3
	Southern pine	SS	8-1	12-9	16-10	21-6
	Southern pine	#1	8-0	12-6	15-10	18-10
	Southern pine	#2	7-8	11-0	14-2	16-11
	Southern pine	#3	5-9	8-6	10-10	12-10
	Spruce-pine-fir	SS	7-8	12-0	15-10	19-5
	Spruce-pine-fir	#1	7-2	10-6	13-3	16-3
	Spruce-pine-fir	#2	7-2	10-6	13-3	16-3
	Spruce-pine-fir	#3	5-5	7-11	10-0	12-3

Check sources for availability of lumber in lengths greater than 20 feet.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kN/m².

a. Span exceeds 26 feet in length.

780 CMR TABLE 5802.5.1(1)
RAFTER SPANS FOR COMMON LUMBER SPECIES
 (Roof live load=20 psf, ceiling not attached to rafters, L/Δ = 180)

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
			2 × 4	2 × 6	2 × 8	2 × 10	2 × 12	2 × 4	2 × 6	2 × 8	2 × 10	2 × 12
			Maximum rafter spans ^a									
			(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)
12	Douglas fir-larch	SS	11-6	18-0	23-9	Note b	Note b	11-6	18-0	23-5	Note b	Note b
	Douglas fir-larch	#1	11-1	17-4	22-5	Note b	Note b	10-6	15-4	19-5	23-9	Note b
	Douglas fir-larch	#2	10-10	16-7	21-0	25-8	Note b	9-10	14-4	18-2	22-3	25-9
	Douglas fir-larch	#3	8-7	12-6	15-10	19-5	22-6	7-5	10-10	13-9	16-9	19-6
	Hem-fir	SS	10-10	17-0	22-5	Note b	Note b	10-10	17-0	22-5	Note b	Note b
	Hem-fir	#1	10-7	16-8	21-10	Note b	Note b	10-3	14-11	18-11	23-2	Note b
	Hem-fir	#2	10-1	15-11	20-8	25-3	Note b	9-8	14-2	17-11	21-11	25-5
	Hem-fir	#3	8-7	12-6	15-10	19-5	22-6	7-5	10-10	13-9	16-9	19-6
	Southern pine	SS	11-3	17-8	23-4	Note b	Note b	11-3	17-8	23-4	Note b	Note b
	Southern pine	#1	11-1	17-4	22-11	Note b	Note b	11-1	17-3	21-9	25-10	Note b
	Southern pine	#2	10-10	17-0	22-5	Note b	Note b	10-6	15-1	19-5	23-2	Note b
	Southern pine	#3	9-1	13-6	17-2	20-3	24-1	7-11	11-8	14-10	17-6	20-11
	Spruce-pine-fir	SS	10-7	16-8	21-11	Note b	Note b	10-7	16-8	21-9	Note b	Note b
	Spruce-pine-fir	#1	10-4	16-3	21-0	25-8	Note b	9-10	14-4	18-2	22-3	25-9
Spruce-pine-fir	#2	10-4	16-3	21-0	25-8	Note b	9-10	14-4	18-2	22-3	25-9	
Spruce-pine-fir	#3	8-7	12-6	15-10	19-5	22-6	7-5	10-10	13-9	16-9	19-6	
16	Douglas fir-larch	SS	10-5	16-4	21-7	Note b	Note b	10-5	16-0	20-3	24-9	Note b
	Douglas fir-larch	#1	10-0	15-4	19-5	23-9	Note b	9-1	13-3	16-10	20-7	23-10
	Douglas fir-larch	#2	9-10	14-4	18-2	22-3	25-9	8-6	12-5	15-9	19-3	22-4
	Douglas fir-larch	#3	7-5	10-10	13-9	16-9	19-6	6-5	9-5	11-11	14-6	16-10
	Hem-fir	SS	9-10	15-6	20-5	Note b	Note b	9-10	15-6	19-11	24-4	Note b
	Hem-fir	#1	9-8	14-11	18-11	23-2	Note b	8-10	12-11	16-5	20-0	23-3
	Hem-fir	#2	9-2	14-2	17-11	21-11	25-5	8-5	12-3	15-6	18-11	22-0
	Hem-fir	#3	7-5	10-10	13-9	16-9	19-6	6-5	9-5	11-11	14-6	16-10
	Southern pine	SS	10-3	16-1	21-2	Note b	Note b	10-3	16-1	21-2	Note b	Note b
	Southern pine	#1	10-0	15-9	20-10	25-10	Note b	10-0	15-0	18-10	22-4	Note b
	Southern pine	#2	9-10	15-1	19-5	23-2	Note b	9-1	13-0	16-10	20-1	23-7
	Southern pine	#3	7-11	11-8	14-10	17-6	20-11	6-10	10-1	12-10	15-2	18-1
	Spruce-pine-fir	SS	9-8	15-2	19-11	25-5	Note b	9-8	14-10	18-10	23-0	Note b
	Spruce-pine-fir	#1	9-5	14-4	18-2	22-3	25-9	8-6	12-5	15-9	19-3	22-4
	Spruce-pine-fir	#2	9-5	14-4	18-2	22-3	25-9	8-6	12-5	15-9	19-3	22-4
	Spruce-pine-fir	#3	7-5	10-10	13-9	16-9	19-6	6-5	9-5	11-11	14-6	16-10
19.2	Douglas fir-larch	SS	9-10	15-5	20-4	25-11	Note b	9-10	14-7	18-6	22-7	Note b
	Douglas fir-larch	#1	9-5	14-0	17-9	21-8	25-2	8-4	12-2	15-4	18-9	21-9
	Douglas fir-larch	#2	8-11	13-1	16-7	20-3	23-6	7-9	11-4	14-4	17-7	20-4
	Douglas fir-larch	#3	6-9	9-11	12-7	15-4	17-9	5-10	8-7	10-10	13-3	15-5
	Hem-fir	SS	9-3	14-7	19-2	24-6	Note b	9-3	14-4	18-2	22-3	25-9
	Hem-fir	#1	9-1	13-8	17-4	21-1	24-6	8-1	11-10	15-0	18-4	21-3
	Hem-fir	#2	8-8	12-11	16-4	20-0	23-2	7-8	11-2	14-2	17-4	20-1
	Hem-fir	#3	6-9	9-11	12-7	15-4	17-9	5-10	8-7	10-10	13-3	15-5
	Southern pine	SS	9-8	15-2	19-11	25-5	Note b	9-8	15-2	19-11	25-5	Note b
	Southern pine	#1	9-5	14-10	19-7	23-7	Note b	9-3	13-8	17-2	20-5	24-4
	Southern pine	#2	9-3	13-9	17-9	21-2	24-10	8-4	11-11	15-4	18-4	21-6
	Southern pine	#3	7-3	10-8	13-7	16-0	19-1	6-3	9-3	11-9	13-10	16-6
	Spruce-pine-fir	SS	9-1	14-3	18-9	23-11	Note b	9-1	13-7	17-2	21-0	24-4
	Spruce-pine-fir	#1	8-10	13-1	16-7	20-3	23-6	7-9	11-4	14-4	17-7	20-4
	Spruce-pine-fir	#2	8-10	13-1	16-7	20-3	23-6	7-9	11-4	14-4	17-7	20-4
	Spruce-pine-fir	#3	6-9	9-11	12-7	15-4	17-9	5-10	8-7	10-10	13-3	15-5

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780 CMR TABLE 5802.5.1(1)- continued.
RAFTER SPANS FOR COMMON LUMBER SPECIES
 (Roof live load=20 psf, ceiling not attached to rafters, $L/\Delta = 180$)

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
			2 × 4	2 × 6	2 × 8	2 × 10	2 × 12	2 × 4	2 × 6	2 × 8	2 × 10	2 × 12
			Maximum rafter spans ^a									
			(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)
24	Douglas fir-larch	SS	9-1	14-4	18-10	23-4	Note b	8-11	13-1	16-7	20-3	23-5
	Douglas fir-larch	#1	8-7	12-6	15-10	19-5	22-6	7-5	10-10	13-9	16-9	19-6
	Douglas fir-larch	#2	8-0	11-9	14-10	18-2	21-0	6-11	10-2	12-10	15-8	18-3
	Douglas fir-larch	#3	6-1	8-10	11-3	13-8	15-11	5-3	7-8	9-9	11-10	13-9
	Hem-fir	SS	8-7	13-6	17-10	22-9	Note b	8-7	12-10	16-3	19-10	23-0
	Hem-fir	#1	8-4	12-6	15-6	18-11	21-11	7-3	10-7	13-5	16-4	19-0
	Hem-fir	#2	7-11	11-7	14-8	17-10	20-9	6-10	10-0	12-8	15-6	17-11
	Hem-fir	#3	6-1	8-10	11-3	13-8	15-11	5-3	7-8	9-9	11-10	13-9
	Southern pine	SS	8-11	14-1	18-6	23-8	Note b	8-11	14-1	18-6	22-11	Note b
	Southern pine	#1	8-9	13-9	17-9	21-1	25-2	8-3	12-3	15-4	18-3	21-9
	Southern pine	#2	8-7	12-3	15-10	18-11	22-2	7-5	10-8	13-9	16-5	19-3
	Southern pine	#3	6-5	9-6	12-1	14-4	17-1	5-7	8-3	10-6	12-5	14-9
	Spruce-pine-fir	SS	8-5	13-3	17-5	21-8	25-2	8-4	12-2	15-4	18-9	21-9
	Spruce-pine-fir	#1	8-0	11-9	14-10	18-2	21-0	6-11	10-2	12-10	15-8	18-3
	Spruce-pine-fir	#2	8-0	11-9	14-10	18-2	21-0	6-11	10-2	12-10	15-8	18-3
	Spruce-pine-fir	#3	6-1	8-10	11-3	13-8	15-11	5-3	7-8	9-9	11-10	13-9

Check sources for availability of lumber in lengths greater than 20 feet.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kN/m².

- a. The tabulate drafter spans assume that ceiling joists are located at the bottom of the attic space or that some other method of resisting the outward push of the rafters on the bearing walls, such as rafter ties, is provided at that location. When ceiling joists or rafter ties are located higher in the attic space, the rafter spans shall be multiplied by the factors given below:

H_c/H_r	Rafter Span Adjustment Factor
2/3 or greater	0.50
1/2	0.58
1/3	0.67
1/4	0.76
1/5	0.83
1/6	0.90
1/7.5 and less	1.00

where: H_c = Height of ceiling joists or rafter ties measured vertically above the top of the rafter support walls. H_r = Height of roof ridge measured vertically above the top of the rafter support walls.

- b. Span exceeds 26 feet in length.

780 CMR TABLE 5802.5.1(2)
RAFTER SPANS FOR COMMON LUMBER SPECIES
 (Roof live load=20 psf, ceiling attached to rafters, $L/\Delta = 240$)

(Roof live load=20 psf, ceiling attached to rafters, L/Δ = 240)												
RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
			2 × 4	2 × 6	2 × 8	2 × 10	2 × 12	2 × 4	2 × 6	2 × 8	2 × 10	2 × 12
			Maximum rafter spans ^a									
			(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	
12	Douglas fir-larch	SS	10-5	16-4	21-7	Note b	Note b	10-5	16-4	21-7	Note b	Note b
	Douglas fir-larch	#1	10-0	15-9	20-10	Note b	Note b	10-0	15-4	19-5	23-9	Note b
	Douglas fir-larch	#2	9-10	15-6	20-5	25-8	Note b	9-10	14-4	18-2	22-3	25-9
	Douglas fir-larch	#3	8-7	12-6	15-10	19-5	22-6	7-5	10-10	13-9	16-9	19-6
	Hem-fir	SS	9-10	15-6	20-5	Note b	Note b	9-10	15-6	20-5	Note b	Note b
	Hem-fir	#1	9-8	15-2	19-11	25-5	Note b	9-8	14-11	18-11	23-2	Note b
	Hem-fir	#2	9-2	14-5	19-0	24-3	Note b	9-2	14-2	17-11	21-11	25-5
	Hem-fir	#3	8-7	12-6	15-10	19-5	22-6	7-5	10-10	13-9	16-9	19-6
	Southern pine	SS	10-3	16-1	21-2	Note b	Note b	10-3	16-1	21-2	Note b	Note b
	Southern pine	#1	10-0	15-9	20-10	Note b	Note b	10-0	15-9	20-10	25-10	Note b
	Southern pine	#2	9-10	15-6	20-5	Note b	Note b	9-10	15-1	19-5	23-2	Note b
	Southern pine	#3	9-1	13-6	17-2	20-3	24-1	7-11	11-8	14-10	17-6	20-11
	Spruce-pine-fir	SS	9-8	15-2	19-11	25-5	Note b	9-8	15-2	19-11	25-5	Note b
	Spruce-pine-fir	#1	9-5	14-9	19-6	24-10	Note b	9-5	14-4	18-2	22-3	25-9
Spruce-pine-fir	#2	9-5	14-9	19-6	24-10	Note b	9-5	14-4	18-2	22-3	25-9	
Spruce-pine-fir	#3	8-7	12-6	15-10	19-5	22-6	7-5	10-10	13-9	16-9	19-6	
16	Douglas fir-larch	SS	9-6	14-11	19-7	25-0	Note b	9-6	14-11	19-7	24-9	Note b
	Douglas fir-larch	#1	9-1	14-4	18-11	23-9	Note b	9-1	13-3	16-10	20-7	23-10
	Douglas fir-larch	#2	8-11	14-1	18-2	22-3	25-9	8-6	12-5	15-9	19-3	22-4
	Douglas fir-larch	#3	7-5	10-10	13-9	16-9	19-6	6-5	9-5	11-11	14-6	16-10
	Hem-fir	SS	8-11	14-1	18-6	23-8	Note b	8-11	14-1	18-6	23-8	Note b
	Hem-fir	#1	8-9	13-9	18-1	23-1	Note b	8-9	12-11	16-5	20-0	23-3
	Hem-fir	#2	8-4	13-1	17-3	21-11	25-5	8-4	12-3	15-6	18-11	22-0
	Hem-fir	#3	7-5	10-10	13-9	16-9	19-6	6-5	9-5	11-11	14-6	16-10
	Southern pine	SS	9-4	14-7	19-3	24-7	Note b	9-4	14-7	19-3	24-7	Note b
	Southern pine	#1	9-1	14-4	18-11	24-1	Note b	9-1	14-4	18-10	22-4	Note b
	Southern pine	#2	8-11	14-1	18-6	23-2	Note b	8-11	13-0	16-10	20-1	23-7
	Southern pine	#3	7-11	11-8	14-10	17-6	20-11	6-10	10-1	12-10	15-2	18-1
	Spruce-pine-fir	SS	8-9	13-9	18-1	23-1	Note b	8-9	13-9	18-1	23-0	Note b
	Spruce-pine-fir	#1	8-7	13-5	17-9	22-3	25-9	8-6	12-5	15-9	19-3	22-4
	Spruce-pine-fir	#2	8-7	13-5	17-9	22-3	25-9	8-6	12-5	15-9	19-3	22-4
	Spruce-pine-fir	#3	7-5	10-10	13-9	16-9	19-6	6-5	9-5	11-11	14-6	16-10
19.2	Douglas fir-larch	SS	8-11	14-0	18-5	23-7	Note b	8-11	14-0	18-5	22-7	Note b
	Douglas fir-larch	#1	8-7	13-6	17-9	21-8	25-2	8-4	12-2	15-4	18-9	21-9
	Douglas fir-larch	#2	8-5	13-1	16-7	20-3	23-6	7-9	11-4	14-4	17-7	20-4
	Douglas fir-larch	#3	6-9	9-11	12-7	15-4	17-9	5-10	8-7	10-10	13-3	15-5
	Hem-fir	SS	8-5	13-3	17-5	22-3	Note b	8-5	13-3	17-5	22-3	25-9
	Hem-fir	#1	8-3	12-11	17-1	21-1	24-6	8-1	11-10	15-0	18-4	21-3
	Hem-fir	#2	7-10	12-4	16-3	20-0	23-2	7-8	11-2	14-2	17-4	20-1
	Hem-fir	#3	6-9	9-11	12-7	15-4	17-9	5-10	8-7	10-10	13-3	15-5
	Southern pine	SS	8-9	13-9	18-1	23-1	Note b	8-9	13-9	18-1	23-1	Note b
	Southern pine	#1	8-7	13-6	17-9	22-8	Note b	8-7	13-6	17-2	20-5	24-4
	Southern pine	#2	8-5	13-3	17-5	21-2	24-10	8-4	11-11	15-4	18-4	21-6
	Southern pine	#3	7-3	10-8	13-7	16-0	19-1	6-3	9-3	11-9	13-10	16-6
	Spruce-pine-fir	SS	8-3	12-11	17-1	21-9	Note b	8-3	12-11	17-1	21-0	24-4
	Spruce-pine-fir	#1	8-1	12-8	16-7	20-3	23-6	7-9	11-4	14-4	17-7	20-4
	Spruce-pine-fir	#2	8-1	12-8	16-7	20-3	23-6	7-9	11-4	14-4	17-7	20-4
	Spruce-pine-fir	#3	6-9	9-11	12-7	15-4	17-9	5-10	8-7	10-10	13-3	15-5

THE MASSACHUSETTS STATE BUILDING CODE

780 CMR TABLE 5802.5.1(2) - continued
RAFTER SPANS FOR COMMON LUMBER SPECIES
 (Roof live load=20 psf, ceiling attached to rafters, $L/\Delta = 240$)

RAFTER SPACING (inches)		SPECIES AND GRADE		DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
				2 x 4	2 x 6	2 x 8	2 x 10	2 x 12	2 x 4	2 x 6	2 x 8	2 x 10	2 x 12
				Maximum rafter spans ^a									
				(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)
24	Douglas fir-larch	SS	8-3	13-0	17-2	21-10	Note b	8-3	13-0	16-7	20-3	23-5	
	Douglas fir-larch	#1	8-0	12-6	15-10	19-5	22-6	7-5	10-10	13-9	16-9	19-6	
	Douglas fir-larch	#2	7-10	11-9	14-10	18-2	21-0	6-11	10-2	12-10	15-8	18-3	
	Douglas fir-larch	#3	6-1	8-10	11-3	13-8	15-11	5-3	7-8	9-9	11-10	13-9	
	Hem-fir	SS	7-10	12-3	16-2	20-8	25-1	7-10	12-3	16-2	19-10	23-0	
	Hem-fir	#1	7-8	12-0	15-6	18-11	21-11	7-3	10-7	13-5	16-4	19-0	
	Hem-fir	#2	7-3	11-5	14-8	17-10	20-9	6-10	10-0	12-8	15-6	17-11	
	Hem-fir	#3	6-1	8-10	11-3	13-8	15-11	5-3	7-8	9-9	11-10	13-9	
	Southern pine	SS	8-1	12-9	16-10	21-6	Note b	8-1	12-9	16-10	21-6	Note b	
	Southern pine	#1	8-0	12-6	16-6	21-1	25-2	8-0	12-3	15-4	18-3	21-9	
	Southern pine	#2	7-10	12-3	15-10	18-11	22-2	7-5	10-8	13-9	16-5	19-3	
	Southern pine	#3	6-5	9-6	12-1	14-4	17-1	5-7	8-3	10-6	12-5	14-9	
	Spruce-pine-fir	SS	7-8	12-0	15-10	20-2	24-7	7-8	12-0	15-4	18-9	21-9	
	Spruce-pine-fir	#1	7-6	11-9	14-10	18-2	21-0	6-11	10-2	12-10	15-8	18-3	
	Spruce-pine-fir	#2	7-6	11-9	14-10	18-2	21-0	6-11	10-2	12-10	15-8	18-3	
	Spruce-pine-fir	#3	6-1	8-10	11-3	13-8	15-11	5-3	7-8	9-9	11-10	13-9	

Check sources for availability of lumber in lengths greater than 20 feet.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kN/m².

- a. The tabulated rafter spans assume that ceiling joists are located at the bottom of the attic space or that some other method of resisting the outward push of the rafters on the bearing walls, such as rafter ties, is provided at that location. When ceiling joists or rafter ties are located higher in the attic space, the rafter spans shall be multiplied by the factors given below:

H_c/H_r	Rafter Span Adjustment Factor
2/3 or greater	0.50
1/2	0.58
1/3	0.67
1/4	0.76
1/5	0.83
1/6	0.90
1/7.5 and less	1.00

where: H_c = Height of ceiling joists or rafter ties measured vertically above the top of the rafter support walls. H_r = Height of roof ridge measured vertically above the top of the rafter support walls.

- b. Span exceeds 26 feet in length.

ROOF CEILING CONSTRUCTION

780 CMR TABLE 5802.5.1(3)
RAFTER SPANS FOR COMMON LUMBER SPECIES
 (Ground snow load=30 psf, ceiling not attached to rafters, L/Δ= 180)

			DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
RAFTER SPACING (inches)	SPECIES AND GRADE		2 x 4	2 x 6	2 x 8	2 x 10	2 x 12	2 x 4	2 x 6	2 x 8	2 x 10	2 x 12
			Maximum rafter spans*									
			(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)
12	Douglas fir-larch	SS	10-0	15-9	20-9	Note b	Note b	10-0	15-9	20-1	24-6	Note b
	Douglas fir-larch	#1	9-8	14-9	18-8	22-9	Note b	9-0	13-2	16-8	20-4	23-7
	Douglas fir-larch	#2	9-5	13-9	17-5	21-4	24-8	8-5	12-4	15-7	19-1	22-1
	Douglas fir-larch	#3	7-1	10-5	13-2	16-1	18-8	6-4	9-4	11-9	14-5	16-8
	Hem-fir	SS	9-6	14-10	19-7	25-0	Note b	9-6	14-10	19-7	24-1	Note b
	Hem-fir	#1	9-3	14-4	18-2	22-2	25-9	8-9	12-10	16-3	19-10	23-0
	Hem-fir	#2	8-10	13-7	17-2	21-0	24-4	8-4	12-2	15-4	18-9	21-9
	Hem-fir	#3	7-1	10-5	13-2	16-1	18-8	6-4	9-4	11-9	14-5	16-8
	Southern pine	SS	9-10	15-6	20-5	Note b	Note b	9-10	15-6	20-5	Note b	Note b
	Southern pine	#1	9-8	15-2	20-0	24-9	Note b	9-8	14-10	18-8	22-2	Note b
	Southern pine	#2	9-6	14-5	18-8	22-3	Note b	9-0	12-11	16-8	19-11	23-4
	Southern pine	#3	7-7	11-2	14-3	16-10	20-0	6-9	10-0	12-9	15-1	17-11
	Spruce-pine-fir	SS	9-3	14-7	19-2	24-6	Note b	9-3	14-7	18-8	22-9	Note b
	Spruce-pine-fir	#1	9-1	13-9	17-5	21-4	24-8	8-5	12-4	15-7	19-1	22-1
Spruce-pine-fir	#2	9-1	13-9	17-5	21-4	24-8	8-5	12-4	15-7	19-1	22-1	
Spruce-pine-fir	#3	7-1	10-5	13-2	16-1	18-8	6-4	9-4	11-9	14-5	16-8	
16	Douglas fir-larch	SS	9-1	14-4	18-10	23-9	Note b	9-1	13-9	17-5	21-3	24-8
	Douglas fir-larch	#1	8-9	12-9	16-2	19-9	22-10	7-10	11-5	14-5	17-8	20-5
	Douglas fir-larch	#2	8-2	11-11	15-1	18-5	21-5	7-3	10-8	13-6	16-6	19-2
	Douglas fir-larch	#3	6-2	9-0	11-5	13-11	16-2	5-6	8-1	10-3	12-6	14-6
	Hem-fir	SS	8-7	13-6	17-10	22-9	Note b	8-7	13-6	17-1	20-10	24-2
	Hem-fir	#1	8-5	12-5	15-9	19-3	22-3	7-7	11-1	14-1	17-2	19-11
	Hem-fir	#2	8-0	11-9	14-11	18-2	21-1	7-2	10-6	13-4	16-3	18-10
	Hem-fir	#3	6-2	9-0	11-5	13-11	16-2	5-6	8-1	10-3	12-6	14-6
	Southern pine	SS	8-11	14-1	18-6	23-8	Note b	8-11	14-1	18-6	23-8	Note b
	Southern pine	#1	8-9	13-9	18-1	21-5	25-7	8-8	12-10	16-2	19-2	22-10
	Southern pine	#2	8-7	12-6	16-2	19-3	22-7	7-10	11-2	14-5	17-3	20-2
	Southern pine	#3	6-7	9-8	12-4	14-7	17-4	5-10	8-8	11-0	13-0	15-6
	Spruce-pine-fir	SS	8-5	13-3	17-5	22-1	25-7	8-5	12-9	16-2	19-9	22-10
	Spruce-pine-fir	#1	8-2	11-11	15-1	18-5	21-5	7-3	10-8	13-6	16-6	19-2
Spruce-pine-fir	#2	8-2	11-11	15-1	18-5	21-5	7-3	10-8	13-6	16-6	19-2	
Spruce-pine-fir	#3	6-2	9-0	11-5	13-11	16-2	5-6	8-1	10-3	12-6	14-6	
19.2	Douglas fir-larch	SS	8-7	13-6	17-9	21-8	25-2	8-7	12-6	15-10	19-5	22-6
	Douglas fir-larch	#1	7-11	11-8	14-9	18-0	20-11	7-1	10-5	13-2	16-1	18-8
	Douglas fir-larch	#2	7-5	10-11	13-9	16-10	19-6	6-8	9-9	12-4	15-1	17-6
	Douglas fir-larch	#3	5-7	8-3	10-5	12-9	14-9	5-0	7-4	9-4	11-5	13-2
	Hem-fir	SS	8-1	12-9	16-9	21-4	24-8	8-1	12-4	15-7	19-1	22-1
	Hem-fir	#1	7-9	11-4	14-4	17-7	20-4	6-11	10-2	12-10	15-8	18-2
	Hem-fir	#2	7-4	10-9	13-7	16-7	19-3	6-7	9-7	12-2	14-10	17-3
	Hem-fir	#3	5-7	8-3	10-5	12-9	14-9	5-0	7-4	9-4	11-5	13-2
	Southern pine	SS	8-5	13-3	17-5	22-3	Note b	8-5	13-3	17-5	22-0	25-9
	Southern pine	#1	8-3	13-0	16-6	19-7	23-4	7-11	11-9	14-9	17-6	20-11
	Southern pine	#2	7-11	11-5	14-9	17-7	20-7	7-1	10-2	13-2	15-9	18-5
	Southern pine	#3	6-0	8-10	11-3	13-4	15-10	5-4	7-11	10-1	11-11	14-2
	Spruce-pine-fir	SS	7-11	12-5	16-5	20-2	23-4	7-11	11-8	14-9	18-0	20-11
	Spruce-pine-fir	#1	7-5	10-11	13-9	16-10	19-6	6-8	9-9	12-4	15-1	17-6
Spruce-pine-fir	#2	7-5	10-11	13-9	16-10	19-6	6-8	9-9	12-4	15-1	17-6	
Spruce-pine-fir	#3	5-7	8-3	10-5	12-9	14-9	5-0	7-4	9-4	11-5	13-2	

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780 CMR TABLE 5802.5.1(3) - continued
RAFTER SPANS FOR COMMON LUMBER SPECIES
 (Ground snow load=30 psf, ceiling not attached to rafters, $L/\Delta=180$)

			DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
RAFTER SPACING (inches)	SPECIES AND GRADE		2 x 4	2 x 6	2 x 8	2 x 10	2 x 12	2 x 4	2 x 6	2 x 8	2 x 10	2 x 12
		Maximum rafter spans ^a										
		(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	
24	Douglas fir-larch	SS	7-11	12-6	15-10	19-5	22-6	7-8	11-3	14-2	17-4	20-1
	Douglas fir-larch	#1	7-1	10-5	13-2	16-1	18-8	6-4	9-4	11-9	14-5	16-8
	Douglas fir-larch	#2	6-8	9-9	12-4	15-1	17-6	5-11	8-8	11-0	13-6	15-7
	Douglas fir-larch	#3	5-0	7-4	9-4	11-5	13-2	4-6	6-7	8-4	10-2	11-10
	Hem-fir	SS	7-6	11-10	15-7	19-1	22-1	7-6	11-0	13-11	17-0	19-9
	Hem-fir	#1	6-11	10-2	12-10	15-8	18-2	6-2	9-1	11-6	14-0	16-3
	Hem-fir	#2	6-7	9-7	12-2	14-10	17-3	5-10	8-7	10-10	13-3	15-5
	Hem-fir	#3	5-0	7-4	9-4	11-5	13-2	4-6	6-7	8-4	10-2	11-10
	Southern pine	SS	7-10	12-3	16-2	20-8	25-1	7-10	12-3	16-2	19-8	23-0
	Southern pine	#1	7-8	11-9	14-9	17-6	20-11	7-1	10-6	13-2	15-8	18-8
	Southern pine	#2	7-1	10-2	13-2	15-9	18-5	6-4	9-2	11-9	14-1	16-6
	Southern pine	#3	5-4	7-11	10-1	11-11	14-2	4-9	7-1	9-0	10-8	12-8
	Spruce-pine-fir	SS	7-4	11-7	14-9	18-0	20-11	7-1	10-5	13-2	16-1	18-8
	Spruce-pine-fir	#1	6-8	9-9	12-4	15-1	17-6	5-11	8-8	11-0	13-6	15-7
	Spruce-pine-fir	#2	6-8	9-9	12-4	15-1	17-6	5-11	8-8	11-0	13-6	15-7
	Spruce-pine-fir	#3	5-0	7-4	9-4	11-5	13-2	4-6	6-7	8-4	10-2	11-10

Check sources for availability of lumber in lengths greater than 20 feet.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kN/m².

- a. The tabulated rafter spans assume that ceiling joists are located at the bottom of the attic space or that some other method of resisting the outward push of the rafters on the bearing walls, such as rafter ties, is provided at that location. When ceiling joists or rafter ties are located higher in the attic space, the rafter spans shall be multiplied by the factors given below:

H_C/H_R	Rafter Span Adjustment Factor
2/3 or greater	0.50
1/2	0.58
1/3	0.67
1/4	0.76
1/5	0.83
1/6	0.90
1/7.5 and less	1.00

where: H_C = Height of ceiling joists or rafter ties measured vertically above the top of the rafter support walls.

H_R = Height of roof ridge measured vertically above the top of the rafter support walls.

- b. Span exceeds 26 feet in length.

780 CMR TABLE 5802.5.1(4)
RAFTER SPANS FOR COMMON LUMBER SPECIES
 (Ground snow load=50 psf, ceiling not attached to rafters, L/Δ= 180)

RAFTER SPACING (inches)	SPECIES AND GRADE	DEAD LOAD = 10 psf					DEAD LOAD = 20 psf					
		2 × 4	2 × 6	2 × 8	2 × 10	2 × 12	2 × 4	2 × 6	2 × 8	2 × 10	2 × 12	
		Maximum rafter spans ^a										
		(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	
12	Douglas fir-larch	SS	8-5	13-3	17-6	22-4	26-0	8-5	13-3	17-0	20-9	24-0
	Douglas fir-larch	#1	8-2	12-0	15-3	18-7	21-7	7-7	11-2	14-1	17-3	20-0
	Douglas fir-larch	#2	7-8	11-3	14-3	17-5	20-2	7-1	10-5	13-2	16-1	18-8
	Douglas fir-larch	#3	5-10	8-6	10-9	13-2	15-3	5-5	7-10	10-0	12-2	14-1
	Hem-fir	SS	8-0	12-6	16-6	21-1	25-6	8-0	12-6	16-6	20-4	23-7
	Hem-fir	#1	7-10	11-9	14-10	18-1	21-0	7-5	10-10	13-9	16-9	19-5
	Hem-fir	#2	7-5	11-1	14-0	17-2	19-11	7-0	10-3	13-0	15-10	18-5
	Hem-fir	#3	5-10	8-6	10-9	13-2	15-3	5-5	7-10	10-0	12-2	14-1
	Southern pine	SS	8-4	13-0	17-2	21-11	Note b	8-4	13-0	17-2	21-11	Note b
	Southern pine	#1	8-2	12-10	16-10	20-3	24-1	8-2	12-6	15-9	18-9	22-4
	Southern pine	#2	8-0	11-9	15-3	18-2	21-3	7-7	10-11	14-1	16-10	19-9
	Southern pine	#3	6-2	9-2	11-8	13-9	16-4	5-9	8-5	10-9	12-9	15-2
	Spruce-pine-fir	SS	7-10	12-3	16-2	20-8	24-1	7-10	12-3	15-9	19-3	22-4
	Spruce-pine-fir	#1	7-8	11-3	14-3	17-5	20-2	7-1	10-5	13-2	16-1	18-8
Spruce-pine-fir	#2	7-8	11-3	14-3	17-5	15-2	7-1	10-5	13-2	16-1	18-8	
Spruce-pine-fir	#3	5-10	8-6	10-9	13-2	20-3	5-5	7-10	10-0	12-2	14-1	
16	Douglas fir-larch	SS	7-8	12-1	15-10	19-5	22-6	7-8	11-7	14-8	17-11	20-10
	Douglas fir-larch	#1	7-1	10-5	13-2	16-1	18-8	6-7	9-8	12-2	14-11	17-3
	Douglas fir-larch	#2	6-8	9-9	12-4	15-1	17-6	6-2	9-0	11-5	13-11	16-2
	Douglas fir-larch	#3	5-0	7-4	9-4	11-5	13-2	4-8	6-10	8-8	10-6	12-3
	Hem-fir	SS	7-3	11-5	15-0	19-1	22-1	7-3	11-5	14-5	17-8	20-5
	Hem-fir	#1	6-11	10-2	12-10	15-8	18-2	6-5	9-5	11-11	14-6	16-10
	Hem-fir	#2	6-7	9-7	12-2	14-10	17-3	6-1	8-11	11-3	13-9	15-11
	Hem-fir	#3	5-0	7-4	9-4	11-5	13-2	4-8	6-10	8-8	10-6	12-3
	Southern pine	SS	7-6	11-10	15-7	19-11	24-3	7-6	11-10	15-7	19-11	23-10
	Southern pine	#1	7-5	11-7	14-9	17-6	20-11	7-4	10-10	13-8	16-2	19-4
	Southern pine	#2	7-1	10-2	13-2	15-9	18-5	6-7	9-5	12-2	14-7	17-1
	Southern pine	#3	5-4	7-11	10-1	11-11	14-2	4-11	7-4	9-4	11-0	13-1
	Spruce-pine-fir	SS	7-1	11-2	14-8	18-0	20-11	7-1	10-9	13-8	15-11	19-4
	Spruce-pine-fir	#1	6-8	9-9	12-4	15-1	17-6	6-2	9-0	11-5	13-11	16-2
	Spruce-pine-fir	#2	6-8	9-9	12-4	15-1	17-6	6-2	9-0	11-5	13-11	16-2
	Spruce-pine-fir	#3	5-0	7-4	9-4	11-5	13-2	4-8	6-10	8-8	10-6	12-3
19.2	Douglas fir-larch	SS	7-3	11-4	14-6	17-8	20-6	7-3	10-7	13-5	16-5	19-0
	Douglas fir-larch	#1	6-6	9-6	12-0	14-8	17-1	6-0	8-10	11-2	13-7	15-9
	Douglas fir-larch	#2	6-1	8-11	11-3	13-9	15-11	5-7	8-3	10-5	12-9	14-9
	Douglas fir-larch	#3	4-7	6-9	8-6	10-5	12-1	4-3	6-3	7-11	9-7	11-2
	Hem-fir	SS	6-10	10-9	14-2	17-5	20-2	6-10	10-5	13-2	16-1	18-8
	Hem-fir	#1	6-4	9-3	11-9	14-4	16-7	5-10	8-7	10-10	13-3	15-5
	Hem-fir	#2	6-0	8-9	11-1	13-7	15-9	5-7	8-1	10-3	12-7	14-7
	Hem-fir	#3	4-7	6-9	8-6	10-5	12-1	4-3	6-3	7-11	9-7	11-2
	Southern pine	SS	7-1	11-2	14-8	18-9	22-10	7-1	11-2	14-8	18-7	21-9
	Southern pine	#1	7-0	10-8	13-5	16-0	19-1	6-8	9-11	12-5	14-10	17-8
	Southern pine	#2	6-6	9-4	12-0	14-4	16-10	6-0	8-8	11-2	13-4	15-7
	Southern pine	#3	4-11	7-3	9-2	10-10	12-11	4-6	6-8	8-6	10-1	12-0
	Spruce-pine-fir	SS	6-8	10-6	13-5	16-5	19-1	6-8	9-10	12-5	15-3	17-8
	Spruce-pine-fir	#1	6-1	8-11	11-3	13-9	15-11	5-7	8-3	10-5	12-9	14-9
	Spruce-pine-fir	#2	6-1	8-11	11-3	13-9	15-11	5-7	8-3	10-5	12-9	14-9
	Spruce-pine-fir	#3	4-7	6-9	8-6	10-5	12-1	4-3	6-3	7-11	9-7	11-2

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780 CMR TABLE 5802.5.1(4) - continued
RAFTER SPANS FOR COMMON LUMBER SPECIES
 (Ground snow load=50 psf, ceiling not attached to rafters, $L/\Delta=180$)

RAFTER SPACING (inches)	SPECIES AND GRADE	DEAD LOAD = 10 psf						DEAD LOAD = 20 psf				
		2 x 4	2 x 6	2 x 8	2 x 10	2 x 12	2 x 4	2 x 6	2 x 8	2 x 10	2 x 12	
		Maximum rafter spans*										
		(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	
24	Douglas fir-larch	SS	6-8	10-5	13-0	15-10	18-4	6-6	9-6	12-0	14-8	17-0
	Douglas fir-larch	#1	5-10	8-6	10-9	13-2	15-3	5-5	7-10	10-0	12-2	14-1
	Douglas fir-larch	#2	5-5	7-11	10-1	12-4	14-3	5-0	7-4	9-4	11-5	13-2
	Douglas fir-larch	#3	4-1	6-0	7-7	9-4	10-9	3-10	5-7	7-1	8-7	10-0
	Hem-fir	SS	6-4	9-11	12-9	15-7	18-0	6-4	9-4	11-9	14-5	16-8
	Hem-fir	#1	5-8	8-3	10-6	12-10	14-10	5-3	7-8	9-9	11-10	13-9
	Hem-fir	#2	5-4	7-10	9-11	12-1	14-1	4-11	7-3	9-2	11-3	13-0
	Hem-fir	#3	4-1	6-0	7-7	9-4	10-9	3-10	5-7	7-1	8-7	10-0
	Southern pine	SS	6-7	10-4	13-8	17-5	21-0	6-7	10-4	13-8	16-7	19-5
	Southern pine	#1	6-5	9-7	12-0	14-4	17-1	6-0	8-10	11-2	13-3	15-9
	Southern pine	#2	5-10	8-4	10-9	12-10	15-1	5-5	7-9	10-0	11-11	13-11
	Southern pine	#3	4-4	6-5	8-3	9-9	11-7	4-1	6-0	7-7	9-0	10-8
	Spruce-pine-fir	SS	6-2	9-6	12-0	14-8	17-1	6-0	8-10	11-2	13-7	15-9
	Spruce-pine-fir	#1	5-5	7-11	10-1	12-4	14-3	5-0	7-4	9-4	11-5	13-2
	Spruce-pine-fir	#2	5-5	7-11	10-1	12-4	14-3	5-0	7-4	9-4	11-5	13-2
	Spruce-pine-fir	#3	4-1	6-0	7-7	9-4	10-9	3-10	5-7	7-1	8-7	10-0

Check sources for availability of lumber in lengths greater than 20 feet.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kN/m².

- a. The tabulated rafter spans assume that ceiling joists are located at the bottom of the attic space or that some other method of resisting the outward push of the rafters on the bearing walls, such as rafter ties, is provided at that location. When ceiling joists or rafter ties are located higher in the attic space, the rafter spans shall be multiplied by the factors given below:

H_C/H_R	Rafter Span Adjustment Factor
2/3 or greater	0.50
1/2	0.58
1/3	0.67
1/4	0.76
1/5	0.83
1/6	0.90
1/7.5 and less	1.00

where: H_C = Height of ceiling joists or rafter ties measured vertically above the top of the rafter support walls. H_R = Height of roof ridge measured vertically above the top of the rafter support walls.

- b. Span exceeds 26 feet in length.

780 CMR TABLE 5802.5.1(5)
RAFTER SPANS FOR COMMON LUMBER SPECIES
 (Ground snow load=30 psf, ceiling attached to rafters, L/Δ = 240)

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
			2 × 4	2 × 6	2 × 8	2 × 10	2 × 12	2 × 4	2 × 6	2 × 8	2 × 10	2 × 12
			Maximum rafter spans ^a									
			(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)
12	Douglas fir-larch	SS	9-1	14-4	18-10	24-1	Note b	9-1	14-4	18-10	24-1	Note b
	Douglas fir-larch	#1	8-9	13-9	18-2	22-9	Note b	8-9	13-2	16-8	20-4	23-7
	Douglas fir-larch	#2	8-7	13-6	17-5	21-4	24-8	8-5	12-4	15-7	19-1	22-1
	Douglas fir-larch	#3	7-1	10-5	13-2	16-1	18-8	6-4	9-4	11-9	14-5	16-8
	Hem-fir	SS	8-7	13-6	17-10	22-9	Note b	8-7	13-6	17-10	22-9	Note b
	Hem-fir	#1	8-5	13-3	17-5	22-2	25-9	8-5	12-10	16-3	19-10	23-0
	Hem-fir	#2	8-0	12-7	16-7	21-0	24-4	8-0	12-2	15-4	18-9	21-9
	Hem-fir	#3	7-1	10-5	13-2	16-1	18-8	6-4	9-4	11-9	14-5	16-8
	Southern pine	SS	8-11	14-1	18-6	23-8	Note b	8-11	14-1	18-6	23-8	Note b
	Southern pine	#1	8-9	13-9	18-2	23-2	Note b	8-9	13-9	18-2	22-2	Note b
	Southern pine	#2	8-7	13-6	17-10	22-3	Note b	8-7	12-11	16-8	19-11	23-4
	Southern pine	#3	7-7	11-2	14-3	16-10	20-0	6-9	10-0	12-9	15-1	17-11
	Spruce-pine-fir	SS	8-5	13-3	17-5	22-3	Note b	8-5	13-3	17-5	22-3	Note b
	Spruce-pine-fir	#1	8-3	12-11	17-0	21-4	24-8	8-3	12-4	15-7	19-1	22-1
	Spruce-pine-fir	#2	8-3	12-11	17-0	21-4	24-8	8-3	12-4	15-7	19-1	22-1
	Spruce-pine-fir	#3	7-1	10-5	13-2	16-1	18-8	6-4	9-4	11-9	14-5	16-8
16	Douglas fir-larch	SS	8-3	13-0	17-2	21-10	Note b	8-3	13-0	17-2	21-3	24-8
	Douglas fir-larch	#1	8-0	12-6	16-2	19-9	22-10	7-10	11-5	14-5	17-8	20-5
	Douglas fir-larch	#2	7-10	11-11	15-1	18-5	21-5	7-3	10-8	13-6	16-6	19-2
	Douglas fir-larch	#3	6-2	9-0	11-5	13-11	16-2	5-6	8-1	10-3	12-6	14-6
	Hem-fir	SS	7-10	12-3	16-2	20-8	25-1	7-10	12-3	16-2	20-8	24-2
	Hem-fir	#1	7-8	12-0	15-9	19-3	22-3	7-7	11-1	14-1	17-2	19-11
	Hem-fir	#2	7-3	11-5	14-11	18-2	21-1	7-2	10-6	13-4	16-3	18-10
	Hem-fir	#3	6-2	9-0	11-5	13-11	16-2	5-6	8-1	10-3	12-6	14-6
	Southern pine	SS	8-1	12-9	16-10	21-6	Note b	8-1	12-9	16-10	21-6	Note b
	Southern pine	#1	8-0	12-6	16-6	21-1	25-7	8-0	12-6	16-2	19-2	22-10
	Southern pine	#2	7-10	12-3	16-2	19-3	22-7	7-10	11-2	14-5	17-3	20-2
	Southern pine	#3	6-7	9-8	12-4	14-7	17-4	5-10	8-8	11-0	13-0	15-6
	Spruce-pine-fir	SS	7-8	12-0	15-10	20-2	24-7	7-8	12-0	15-10	19-9	22-10
	Spruce-pine-fir	#1	7-6	11-9	15-1	18-5	21-5	7-3	10-8	13-6	16-6	19-2
	Spruce-pine-fir	#2	7-6	11-9	15-1	18-5	21-5	7-3	10-8	13-6	16-6	19-2
	Spruce-pine-fir	#3	6-2	9-0	11-5	13-11	16-2	5-6	8-1	10-3	12-6	14-6
19.2	Douglas fir-larch	SS	7-9	12-3	16-1	20-7	25-0	7-9	12-3	15-10	19-5	22-6
	Douglas fir-larch	#1	7-6	11-8	14-9	18-0	20-11	7-1	10-5	13-2	16-1	18-8
	Douglas fir-larch	#2	7-4	10-11	13-9	16-10	19-6	6-8	9-9	12-4	15-1	17-6
	Douglas fir-larch	#3	5-7	8-3	10-5	12-9	14-9	5-0	7-4	9-4	11-5	13-2
	Hem-fir	SS	7-4	11-7	15-3	19-5	23-7	7-4	11-7	15-3	19-1	22-1
	Hem-fir	#1	7-2	11-4	14-4	17-7	20-4	6-11	10-2	12-10	15-8	18-2
	Hem-fir	#2	6-10	10-9	13-7	16-7	19-3	6-7	9-7	12-2	14-10	17-3
	Hem-fir	#3	5-7	8-3	10-5	12-9	14-9	5-0	7-4	9-4	11-5	13-2
	Southern pine	SS	7-8	12-0	15-10	20-2	24-7	7-8	12-0	15-10	20-2	24-7
	Southern pine	#1	7-6	11-9	15-6	19-7	23-4	7-6	11-9	14-9	17-6	20-11
	Southern pine	#2	7-4	11-5	14-9	17-7	20-7	7-1	10-2	13-2	15-9	18-5
	Southern pine	#3	6-0	8-10	11-3	13-4	15-10	5-4	7-11	10-1	11-11	14-2
	Spruce-pine-fir	SS	7-2	11-4	14-11	19-0	23-1	7-2	11-4	14-9	18-0	20-11
	Spruce-pine-fir	#1	7-0	10-11	13-9	16-10	19-6	6-8	9-9	12-4	15-1	17-6
	Spruce-pine-fir	#2	7-0	10-11	13-9	16-10	19-6	6-8	9-9	12-4	15-1	17-6
	Spruce-pine-fir	#3	5-7	8-3	10-5	12-9	14-9	5-0	7-4	9-4	11-5	13-2

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780 CMR TABLE 5802.5.1(5) - continued
RAFTER SPANS FOR COMMON LUMBER SPECIES
 (Ground snow load=30 psf, ceiling attached to rafters, $L/\Delta = 240$)

RAFTER SPACING (inches)		SPECIES AND GRADE		DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
				2 × 4	2 × 6	2 × 8	2 × 10	2 × 12	2 × 4	2 × 6	2 × 8	2 × 10	2 × 12
				Maximum rafter spans ^a									
				(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)
24	Douglas fir-larch	SS	7-3	11-4	15-0	19-1	22-6	7-3	11-3	14-2	17-4	20-1	
	Douglas fir-larch	#1	7-0	10-5	13-2	16-1	18-8	6-4	9-4	11-9	14-5	16-8	
	Douglas fir-larch	#2	6-8	9-9	12-4	15-1	17-6	5-11	8-8	11-0	13-6	15-7	
	Douglas fir-larch	#3	5-0	7-4	9-4	11-5	13-2	4-6	6-7	8-4	10-2	11-10	
	Hem-fir	SS	6-10	10-9	14-2	18-0	21-11	6-10	10-9	13-11	17-0	19-9	
	Hem-fir	#1	6-8	10-2	12-10	15-8	18-2	6-2	9-1	11-6	14-0	16-3	
	Hem-fir	#2	6-4	9-7	12-2	14-10	17-3	5-10	8-7	10-10	13-3	15-5	
	Hem-fir	#3	5-0	7-4	9-4	11-5	13-2	4-6	6-7	8-4	10-2	11-10	
	Southern pine	SS	7-1	11-2	14-8	18-9	22-10	7-1	11-2	14-8	18-9	22-10	
	Southern pine	#1	7-0	10-11	14-5	17-6	20-11	7-0	10-6	13-2	15-8	18-8	
	Southern pine	#2	6-10	10-2	13-2	15-9	18-5	6-4	9-2	11-9	14-1	16-6	
	Southern pine	#3	5-4	7-11	10-1	11-11	14-2	4-9	7-1	9-0	10-8	12-8	
	Spruce-pine-fir	SS	6-8	10-6	13-10	17-8	20-11	6-8	10-5	13-2	16-1	18-8	
	Spruce-pine-fir	#1	6-6	9-9	12-4	15-1	17-6	5-11	8-8	11-10	13-6	15-7	
	Spruce-pine-fir	#2	6-6	9-9	12-4	15-1	17-6	5-11	8-8	11-10	13-6	15-7	
	Spruce-pine-fir	#3	5-0	7-4	9-4	11-5	13-2	4-6	6-7	8-4	10-2	11-10	

Check sources for availability of lumber in lengths greater than 20 feet.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kN/m².

- a. The tabulated rafter spans assume that ceiling joists are located at the bottom of the attic space or that some other method of resisting the outward push of the rafters on the bearing walls, such as rafter ties, is provided at that location. When ceiling joists or rafter ties are located higher in the attic space, the rafter spans shall be multiplied by the factors given below:

H_c/H_r	Rafter Span Adjustment Factor
2/3 or greater	0.50
1/2	0.58
1/3	0.67
1/4	0.76
1/5	0.83
1/6	0.90
1/7.5 and less	1.00

where: H_c = Height of ceiling joists or rafter ties measured vertically above the top of the rafter support walls. H_r = Height of roof ridge measured vertically above the top of the rafter support walls.

- b. Span exceeds 26 feet in length.

780 CMR TABLE 5802.5.1(6)
RAFTER SPANS FOR COMMON LUMBER SPECIES
 (Ground snow load=50 psf, ceiling attached to rafters, L/Δ = 240)

RAFTER SPACING (inches)	SPECIES AND GRADE	DEAD LOAD = 10 psf					DEAD LOAD = 20 psf					
		2 × 4	2 × 6	2 × 8	2 × 10	2 × 12	2 × 4	2 × 6	2 × 8	2 × 10	2 × 12	
		Maximum rafter spans ^a										
		(feet- inches)	(feet- inches)	(feet- inches)	(feet- inches)	(feet- inches)	(feet- inches)	(feet- inches)	(feet- inches)	(feet- inches)	(feet- inches)	
12	Douglas fir-larch	SS	7-8	12-1	15-11	20-3	24-8	7-8	12-1	15-11	20-3	24-0
	Douglas fir-larch	#1	7-5	11-7	15-3	18-7	21-7	7-5	11-2	14-1	17-3	20-0
	Douglas fir-larch	#2	7-3	11-3	14-3	17-5	20-2	7-1	10-5	13-2	16-1	18-8
	Douglas fir-larch	#3	5-10	8-6	10-9	13-2	15-3	5-5	7-10	10-0	12-2	14-1
	Hem-fir	SS	7-3	11-5	15-0	19-2	23-4	7-3	11-5	15-0	19-2	23-4
	Hem-fir	#1	7-1	11-2	14-8	18-1	21-0	7-1	10-10	13-9	16-9	19-5
	Hem-fir	#2	6-9	10-8	14-0	17-2	19-11	6-9	10-3	13-0	15-10	18-5
	Hem-fir	#3	5-10	8-6	10-9	13-2	15-3	5-5	7-10	10-0	12-2	14-1
	Southern pine	SS	7-6	11-10	15-7	19-11	24-3	7-6	11-10	15-7	19-11	24-3
	Southern pine	#1	7-5	11-7	15-4	19-7	23-9	7-5	11-7	15-4	18-9	22-4
	Southern pine	#2	7-3	11-5	15-0	18-2	21-3	7-3	10-11	14-1	16-10	19-9
	Southern pine	#3	6-2	9-2	11-8	13-9	16-4	5-9	8-5	10-9	12-9	15-2
	Spruce-pine-fir	SS	7-1	11-2	14-8	18-9	22-10	7-1	11-2	14-8	18-9	22-4
	Spruce-pine-fir	#1	6-11	10-11	14-3	17-5	20-2	6-11	10-5	13-2	16-1	18-8
Spruce-pine-fir	#2	6-11	10-11	14-3	17-5	20-2	6-11	10-5	13-2	16-1	18-8	
Spruce-pine-fir	#3	5-10	8-6	10-9	13-2	15-3	5-5	7-10	10-0	12-2	14-1	
16	Douglas fir-larch	SS	7-0	11-0	14-5	18-5	22-5	7-0	11-0	14-5	17-11	20-10
	Douglas fir-larch	#1	6-9	10-5	13-2	16-1	18-8	6-7	9-8	12-2	14-11	17-3
	Douglas fir-larch	#2	6-7	9-9	12-4	15-1	17-6	6-2	9-0	11-5	13-11	16-2
	Douglas fir-larch	#3	5-0	7-4	9-4	11-5	13-2	4-8	6-10	8-8	10-6	12-3
	Hem-fir	SS	6-7	10-4	13-8	17-5	21-2	6-7	10-4	13-8	17-5	20-5
	Hem-fir	#1	6-5	10-2	12-10	15-8	18-2	6-5	9-5	11-11	14-6	16-10
	Hem-fir	#2	6-2	9-7	12-2	14-10	17-3	6-1	8-11	11-3	13-9	15-11
	Hem-fir	#3	5-0	7-4	9-4	11-5	13-2	4-8	6-10	8-8	10-6	12-3
	Southern pine	SS	6-10	10-9	14-2	18-1	22-0	6-10	10-9	14-2	18-1	22-0
	Southern pine	#1	6-9	10-7	13-11	17-6	20-11	6-9	10-7	13-8	16-2	19-4
	Southern pine	#2	6-7	10-2	13-2	15-9	18-5	6-7	9-5	12-2	14-7	17-1
	Southern pine	#3	5-4	7-11	10-1	11-11	14-2	4-11	7-4	9-4	11-0	13-1
	Spruce-pine-fir	SS	6-5	10-2	13-4	17-0	20-9	6-5	10-2	13-4	16-8	19-4
	Spruce-pine-fir	#1	6-4	9-9	12-4	15-1	17-6	6-2	9-0	11-5	13-11	16-2
Spruce-pine-fir	#2	6-4	9-9	12-4	15-1	17-6	6-2	9-0	11-5	13-11	16-2	
Spruce-pine-fir	#3	5-0	7-4	9-4	11-5	13-2	4-8	6-10	8-8	10-6	12-3	
19.2	Douglas fir-larch	SS	6-7	10-4	13-7	17-4	20-6	6-7	10-4	13-5	16-5	19-0
	Douglas fir-larch	#1	6-4	9-6	12-0	14-8	17-1	6-0	8-10	11-2	13-7	15-9
	Douglas fir-larch	#2	6-1	8-11	11-3	13-9	15-11	5-7	8-3	10-5	12-9	14-9
	Douglas fir-larch	#3	4-7	6-9	8-6	10-5	12-1	4-3	6-3	7-11	9-7	11-2
	Hem-fir	SS	6-2	9-9	12-10	16-5	19-11	6-2	9-9	12-10	16-1	18-8
	Hem-fir	#1	6-1	9-3	11-9	14-4	16-7	5-10	8-7	10-10	13-3	15-5
	Hem-fir	#2	5-9	8-9	11-1	13-7	15-9	5-7	8-1	10-3	12-7	14-7
	Hem-fir	#3	4-7	6-9	8-6	10-5	12-1	4-3	6-3	7-11	9-7	11-2
	Southern pine	SS	6-5	10-2	13-4	17-0	20-9	6-5	10-2	13-4	17-0	20-9
	Southern pine	#1	6-4	9-11	13-1	16-0	19-1	6-4	9-11	12-5	14-10	17-8
	Southern pine	#2	6-2	9-4	12-0	14-4	16-10	6-0	8-8	11-2	13-4	15-7
	Southern pine	#3	4-11	7-3	9-2	10-10	12-11	4-6	6-8	8-6	10-1	12-0
	Spruce-pine-fir	SS	6-1	9-6	12-7	16-0	19-1	6-1	9-6	12-5	15-3	17-8
	Spruce-pine-fir	#1	5-11	8-11	11-3	13-9	15-11	5-7	8-3	10-5	12-9	14-9
Spruce-pine-fir	#2	5-11	8-11	11-3	13-9	15-11	5-7	8-3	10-5	12-9	14-9	
Spruce-pine-fir	#3	4-7	6-9	8-6	10-5	12-1	4-3	6-3	7-11	9-7	11-2	

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780 CMR TABLE 5802.5.1(6) - continued
RAFTER SPANS FOR COMMON LUMBER SPECIES
 (Ground snow load=50 psf, ceiling attached to rafters, $L/\Delta = 240$)

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
			2 x 4	2 x 6	2 x 8	2 x 10	2 x 12	2 x 4	2 x 6	2 x 8	2 x 10	2 x 12
			Maximum rafter spans ^a									
			(feet- inches)	(feet- inches)	(feet- inches)	(feet- inches)	(feet- inches)	(feet- inches)	(feet- inches)	(feet- inches)	(feet- inches)	(feet- inches)
24	Douglas fir-larch	SS	6-1	9-7	12-7	15-10	18-4	6-1	9-6	12-0	14-8	17-0
	Douglas fir-larch	#1	5-10	8-6	10-9	13-2	15-3	5-5	7-10	10-0	12-2	14-1
	Douglas fir-larch	#2	5-5	7-11	10-1	12-4	14-3	5-0	7-4	9-4	11-5	13-2
	Douglas fir-larch	#3	4-1	6-0	7-7	9-4	10-9	3-10	5-7	7-1	8-7	10-0
	Hem-fir	SS	5-9	9-1	11-11	15-2	18-0	5-9	9-1	11-9	14-5	15-11
	Hem-fir	#1	5-8	8-3	10-6	12-10	14-10	5-3	7-8	9-9	11-10	13-9
	Hem-fir	#2	5-4	7-10	9-11	12-1	14-1	4-11	7-3	9-2	11-3	13-0
	Hem-fir	#3	4-1	6-0	7-7	9-4	10-9	3-10	5-7	7-1	8-7	10-0
	Southern pine	SS	6-0	9-5	12-5	15-10	19-3	6-0	9-5	12-5	15-10	19-3
	Southern pine	#1	5-10	9-3	12-0	14-4	17-1	5-10	8-10	11-2	13-0	15-9
	Southern pine	#2	5-9	8-4	10-9	12-10	15-1	5-5	7-9	10-0	11-11	13-11
	Southern pine	#3	4-4	6-5	8-3	9-9	11-7	4-1	6-0	7-7	9-0	10-8
	Spruce-pine-fir	SS	5-8	8-10	11-8	14-8	17-1	5-8	8-10	11-2	13-7	15-9
	Spruce-pine-fir	#1	5-5	7-11	10-1	12-4	14-3	5-0	7-4	9-4	11-5	13-2
	Spruce-pine-fir	#2	5-5	7-11	10-1	12-4	14-3	5-0	7-4	9-4	11-5	13-2
	Spruce-pine-fir	#3	4-1	6-0	7-7	9-4	10-9	3-10	5-7	7-1	8-7	10-0

Check sources for availability of lumber in lengths greater than 20 feet.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kN/m².

- a. The tabulated rafter spans assume that ceiling joists are located at the bottom of the attic space or that some other method of resisting the outward push of the rafters on the bearing walls, such as rafter ties, is provided at that location. When ceiling joists or rafter ties are located higher in the attic space, the rafter spans shall be multiplied by the factors given below:

H_C/H_R	Rafter Span Adjustment Factor
2/3 or greater	0.50
1/2	0.58
1/3	0.67
1/4	0.76
1/5	0.83
1/6	0.90
1/7.5 and less	1.00

where: H_C = Height of ceiling joists or rafter ties measured vertically above the top of the rafter support walls. H_R = Height of roof ridge measured vertically above the top of the rafter support walls.

780 CMR TABLE 5802.5.1(7)
RAFTER SPANS FOR 70 PSF GROUND SNOW LOAD
 (Ceiling not attached to rafters, $L/\Delta = 180$)

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
			2 x 4	2 x 6	2 x 8	2 x 10	2 x 12	2 x 4	2 x 6	2 x 8	2 x 10	2 x 12
			Maximum Rafter Spans ²									
			(feet- inches)	(feet- inches)	(feet- inches)	(feet- inches)	(feet- inches)	(feet- inches)	(feet- inches)	(feet- inches)	(feet- inches)	(feet- inches)
12	Douglas fir-larch	SS	7-7	11-10	15-8	19-5	22-6	7-7	11-10	15-0	18-3	21-2
	Douglas fir-larch	#1	7-1	10-5	13-2	16-1	18-8	6-8	9-10	12-5	15-2	17-7
	Douglas fir-larch	#2	6-8	9-9	12-4	15-1	17-6	6-3	9-2	11-8	14-2	16-6
	Douglas fir-larch	#3	5-0	7-4	9-4	11-5	13-2	4-9	6-11	8-9	10-9	12-5
	Hem-fir	SS	7-2	11-3	14-9	18-10	22-1	7-2	11-3	14-8	18-0	20-10
	Hem-fir	#1	6-11	10-2	12-10	15-8	18-2	6-6	9-7	12-1	14-10	17-2
	Hem-fir	#2	6-7	9-7	12-2	14-10	17-3	6-2	9-1	11-5	14-0	16-3
	Hem-fir	#3	5-0	7-4	9-4	11-5	13-2	4-9	6-11	8-9	10-9	12-5
	Southern pine	SS	7-5	11-8	15-4	19-7	23-10	7-5	11-8	15-4	19-7	23-10
	Southern pine	#1	7-3	11-5	14-9	17-6	20-11	7-3	11-1	13-11	16-6	19-8
	Southern pine	#2	7-1	10-2	13-2	15-9	18-5	6-8	9-7	12-5	14-10	17-5
	Southern pine	#3	5-4	7-11	10-1	11-11	14-2	5-1	7-5	9-6	11-3	13-4
	Spruce-pine-fir	SS	7-0	11-0	14-6	18-0	20-11	7-0	11-10	13-11	17-0	19-8
	Spruce-pine-fir	#1	6-8	9-9	12-4	15-1	17-6	6-3	9-2	11-8	14-2	16-6
	Spruce-pine-fir	#2	6-8	9-9	12-4	15-1	17-6	6-3	9-2	11-8	14-2	16-6
	Spruce-pine-fir	#3	5-0	7-4	9-4	11-5	13-2	4-9	6-11	8-9	10-9	12-5
16	Douglas fir-larch	SS	6-10	10-9	13-9	16-10	19-6	6-10	10-3	13-0	15-10	18-4
	Douglas fir-larch	#1	6-2	9-0	11-5	13-11	16-2	5-10	8-6	10-9	13-2	15-3
	Douglas fir-larch	#2	5-9	8-5	10-8	13-1	15-2	5-5	7-11	10-1	12-4	14-3
	Douglas fir-larch	#3	4-4	6-4	8-1	9-10	11-5	4-1	6-0	7-7	9-4	10-9
	Hem-fir	SS	6-6	10-2	13-5	16-6	19-2	6-6	10-1	12-9	15-7	18-0
	Hem-fir	#1	6-0	8-9	11-2	13-7	15-9	5-8	8-3	10-6	12-10	14-10
	Hem-fir	#2	5-8	8-4	10-6	12-10	14-11	5-4	7-10	9-11	12-1	14-1
	Hem-fir	#3	4-4	6-4	8-1	9-10	11-5	4-1	6-0	7-7	9-4	10-9
	Southern pine	SS	6-9	10-7	14-0	17-10	21-8	6-9	10-7	14-0	17-10	21-0
	Southern pine	#1	6-7	10-2	12-9	15-2	18-1	6-5	9-7	12-0	14-4	17-1
	Southern pine	#2	6-2	8-10	11-5	13-7	16-0	5-10	8-4	10-9	12-10	15-1
	Southern pine	#3	4-8	6-10	8-9	10-4	12-3	4-4	6-5	8-3	9-9	11-7
	Spruce-pine-fir	SS	6-4	10-0	12-9	15-7	18-1	6-4	9-6	12-0	14-8	17-1
	Spruce-pine-fir	#1	5-9	8-5	10-8	13-1	15-2	5-5	7-11	10-1	12-4	14-3
	Spruce-pine-fir	#2	5-9	8-5	10-8	13-1	15-2	5-5	7-11	10-1	12-4	14-3
	Spruce-pine-fir	#3	4-4	6-4	8-1	9-10	11-5	4-1	6-0	7-7	9-4	10-9
19.2	Douglas fir-larch	SS	6-5	9-11	12-7	15-4	17-9	6-5	9-4	11-10	14-5	16-9
	Douglas fir-larch	#1	5-7	8-3	10-5	12-9	14-9	5-4	7-9	9-10	12-0	13-11
	Douglas fir-larch	#2	5-3	7-8	9-9	11-11	13-10	5-0	7-3	9-2	11-3	13-0
	Douglas fir-larch	#3	4-0	5-10	7-4	9-0	10-5	3-9	5-6	6-11	8-6	9-10
	Hem-fir	SS	6-1	9-7	12-4	15-1	17-4	6-1	9-2	11-8	14-2	15-5
	Hem-fir	#1	5-6	8-0	10-2	12-5	14-5	5-2	7-7	9-7	11-8	13-7
	Hem-fir	#2	5-2	7-7	9-7	11-9	13-7	4-11	7-2	9-1	11-1	12-10
	Hem-fir	#3	4-0	5-10	7-4	9-0	10-5	3-9	5-6	6-11	8-6	9-10
	Southern pine	SS	6-4	10-0	13-2	16-9	20-4	6-4	10-0	13-2	16-5	19-2
	Southern pine	#1	6-3	9-3	11-8	13-10	16-6	5-11	8-9	11-0	13-1	15-7
	Southern pine	#2	5-7	8-1	10-5	12-5	14-7	5-4	7-7	9-10	11-9	13-9
	Southern pine	#3	4-3	6-3	8-0	9-5	11-2	4-0	5-11	7-6	8-10	10-7
	Spruce-pine-fir	SS	6-0	9-2	11-8	14-3	16-6	5-11	8-8	11-10	13-5	15-7
	Spruce-pine-fir	#1	5-3	7-8	9-9	11-11	13-10	5-0	7-3	9-2	11-3	13-0
	Spruce-pine-fir	#2	5-3	7-8	9-9	11-11	13-10	5-0	7-3	9-2	11-3	13-0
	Spruce-pine-fir	#3	4-0	5-10	7-4	9-0	10-5	3-9	5-6	6-11	8-6	9-10

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780 CMR TABLE 5802.5.1(7) - continued
RAFTER SPANS FOR 70 PSF GROUND SNOW LOAD
(Ceiling not attached to rafters, $L/\Delta = 180$)

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
			2 × 4	2 × 6	2 × 8	2 × 10	2 × 12	2 × 4	2 × 6	2 × 8	2 × 10	2 × 12
			Maximum Rafter Spans ^a									
			(feet- inches)	(feet- inches)	(feet- inches)	(feet- inches)	(feet- inches)	(feet- inches)	(feet- inches)	(feet- inches)	(feet- inches)	(feet- inches)
24	Douglas fir-larch	SS	6-0	8-10	11-3	13-9	15-11	5-9	8-4	10-7	12-11	15-0
	Douglas fir-larch	#1	5-0	7-4	9-4	11-5	13-2	4-9	6-11	8-9	10-9	12-5
	Douglas fir-larch	#2	4-8	6-11	8-9	10-8	12-4	4-5	6-6	8-3	10-0	11-8
	Douglas fir-larch	#3	3-7	5-2	6-7	8-1	9-4	3-4	4-11	6-3	7-7	8-10
	Hem-fir	SS	5-8	8-8	11-10	13-6	13-11	5-7	8-3	10-5	12-4	12-4
	Hem-fir	#1	4-11	7-2	9-1	11-1	12-10	4-7	6-9	8-7	10-6	12-2
	Hem-fir	#2	4-8	6-9	8-7	10-6	12-2	4-4	6-5	8-1	9-11	11-6
	Hem-fir	#3	3-7	5-2	6-7	8-1	9-4	3-4	4-11	6-3	7-7	8-10
	Southern pine	SS	5-11	9-3	12-2	15-7	18-2	5-11	9-3	12-2	14-8	17-2
	Southern pine	#1	5-7	8-3	10-5	12-5	14-9	5-3	7-10	9-10	11-8	13-11
	Southern pine	#2	5-0	7-3	9-4	11-1	13-0	4-9	6-10	8-9	10-6	12-4
	Southern pine	#3	3-9	5-7	7-1	8-5	10-0	3-7	5-3	6-9	7-11	9-5
	Spruce-pine-fir	SS	5-6	8-3	10-5	12-9	14-9	5-4	7-9	9-10	12-0	12-11
	Spruce-pine-fir	#1	4-8	6-11	8-9	10-8	12-4	4-5	6-6	8-3	10-0	11-8
	Spruce-pine-fir	#2	4-8	6-11	8-9	10-8	12-4	4-5	6-6	8-3	10-0	11-8
	Spruce-pine-fir	#3	3-7	5-2	6-7	8-1	9-4	3-4	4-11	6-3	7-7	8-10

Check sources for availability of lumber in lengths greater than 20 feet.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kN/m².

- a. The tabulated rafter spans assume that ceiling joists are located at the bottom of the attic space or that some other method of resisting the outward push of the rafters on the bearing walls, such as rafter ties, is provided at that location. When ceiling joists or rafter ties are located higher in the attic space, the rafter spans shall be multiplied by the factors given below:

H_C/H_R	Rafter Span Adjustment Factor
2/3 or greater	0.50
1/2	0.58
1/3	0.67
1/4	0.76
1/5	0.83
1/6	0.90
1/7.5 and less	1.00

where: H_C = Height of ceiling joists or rafter ties measured vertically above the top of the rafter support walls. H_R = Height of roof ridge measured vertically above the top of the rafter support walls.

780 CMR TABLE 5802.5.1(8)
RAFTER SPANS FOR 70 PSF GROUND SNOW LOAD
(Ceiling attached to rafters, $L/\Delta = 240$)

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
			2 x 4	2 x 6	2 x 8	2 x 10	2 x 12	2 x 4	2 x 6	2 x 8	2 x 10	2 x 12
			Maximum rafter spans*									
			(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)
12	Douglas fir-larch	SS	6-10	10-9	14-3	18-2	22-1	6-10	10-9	14-3	18-2	21-2
	Douglas fir-larch	#1	6-7	10-5	13-2	16-1	18-8	6-7	9-10	12-5	15-2	17-7
	Douglas fir-larch	#2	6-6	9-9	12-4	15-1	17-6	6-3	9-2	11-8	14-2	16-6
	Douglas fir-larch	#3	5-0	7-4	9-4	11-5	13-2	4-9	6-11	8-9	10-9	12-5
	Hem-fir	SS	6-6	10-2	13-5	17-2	20-10	6-6	10-2	13-5	17-2	20-10
	Hem-fir	#1	6-4	10-0	12-10	15-8	18-2	6-4	9-7	12-1	14-10	17-2
	Hem-fir	#2	6-1	9-6	12-2	14-10	17-3	6-1	9-1	11-5	14-0	16-3
	Hem-fir	#3	5-0	7-4	9-4	11-5	13-2	4-9	6-11	8-9	10-9	12-5
	Southern pine	SS	6-9	10-7	14-0	17-10	21-8	6-9	10-7	14-0	17-10	21-8
	Southern pine	#1	6-7	10-5	13-8	17-6	20-11	6-7	10-5	13-8	16-6	19-8
	Southern pine	#2	6-6	10-2	13-2	15-9	18-5	6-6	9-7	12-5	14-10	17-5
	Southern pine	#3	5-4	7-11	10-1	11-11	14-2	5-1	7-5	9-6	11-3	13-4
	Spruce-pine-fir	SS	6-4	10-0	13-2	16-9	20-5	6-4	10-0	13-2	16-9	19-8
	Spruce-pine-fir	#1	6-2	9-9	12-4	15-1	17-6	6-2	9-2	11-8	14-2	16-6
Spruce-pine-fir	#2	6-2	9-9	12-4	15-1	17-6	6-2	9-2	11-8	14-2	16-6	
Spruce-pine-fir	#3	5-0	7-4	9-4	11-5	13-2	4-9	6-11	8-9	10-9	12-5	
16	Douglas fir-larch	SS	6-3	9-10	12-11	16-6	19-6	6-3	9-10	12-11	15-10	18-4
	Douglas fir-larch	#1	6-0	9-0	11-5	13-11	16-2	5-10	8-6	10-9	13-2	15-3
	Douglas fir-larch	#2	5-9	8-5	10-8	13-1	15-2	5-5	7-11	10-1	12-4	14-3
	Douglas fir-larch	#3	4-4	6-4	8-1	9-10	11-5	4-1	6-0	7-7	9-4	10-9
	Hem-fir	SS	5-11	9-3	12-2	15-7	18-11	5-11	9-3	12-2	15-7	18-0
	Hem-fir	#1	5-9	8-9	11-2	13-7	15-9	5-8	8-3	10-6	12-10	14-10
	Hem-fir	#2	5-6	8-4	10-6	12-10	14-11	5-4	7-10	9-11	12-1	14-1
	Hem-fir	#3	4-4	6-4	8-1	9-10	11-5	4-1	6-0	7-7	9-4	10-9
	Southern pine	SS	6-1	9-7	12-8	16-2	19-8	6-1	9-7	12-8	16-2	19-8
	Southern pine	#1	6-0	9-5	12-5	15-2	18-1	6-0	9-5	12-0	14-4	17-1
	Southern pine	#2	5-11	8-10	11-5	13-7	16-0	5-10	8-4	10-9	12-10	15-1
	Southern pine	#3	4-8	6-10	8-9	10-4	12-3	4-4	6-5	8-3	9-9	11-7
	Spruce-pine-fir	SS	5-9	9-1	11-11	15-3	18-1	5-9	9-1	11-11	14-8	17-1
	Spruce-pine-fir	#1	5-8	8-5	10-8	13-1	15-2	5-5	7-11	10-1	12-4	14-3
	Spruce-pine-fir	#2	5-8	8-5	10-8	13-1	15-2	5-5	7-11	10-1	12-4	14-3
	Spruce-pine-fir	#3	4-4	6-4	8-1	9-10	11-5	4-1	6-0	7-7	9-4	10-9
19.2	Douglas fir-larch	SS	5-10	9-3	12-2	15-4	17-9	5-10	9-3	11-10	14-5	16-9
	Douglas fir-larch	#1	5-7	8-3	10-5	12-9	14-9	5-4	7-9	9-10	12-0	13-11
	Douglas fir-larch	#2	5-3	7-8	9-9	11-11	13-10	5-0	7-3	9-2	11-3	13-0
	Douglas fir-larch	#3	4-0	5-10	7-4	9-0	10-5	3-9	5-6	6-11	8-6	9-10
	Hem-fir	SS	5-6	8-8	11-6	14-8	17-4	5-6	8-8	11-6	14-2	15-5
	Hem-fir	#1	5-5	8-0	10-2	12-5	14-5	5-2	7-7	9-7	11-8	13-7
	Hem-fir	#2	5-2	7-7	9-7	11-9	13-7	4-11	7-2	9-1	11-1	12-10
	Hem-fir	#3	4-0	5-10	7-4	9-0	10-5	3-9	5-6	6-11	8-6	9-10
	Southern pine	SS	5-9	9-1	11-11	15-3	18-6	5-9	9-1	11-11	15-3	18-6
	Southern pine	#1	5-8	8-11	11-8	13-10	16-6	5-8	8-9	11-0	13-1	15-7
	Southern pine	#2	5-6	8-1	10-5	12-5	14-7	5-4	7-7	9-10	11-9	13-9
	Southern pine	#3	4-3	6-3	8-0	9-5	11-2	4-0	5-11	7-6	8-10	10-7
	Spruce-pine-fir	SS	5-5	8-6	11-3	14-3	16-6	5-5	8-6	11-0	13-5	15-7
	Spruce-pine-fir	#1	5-3	7-8	9-9	11-11	13-10	5-0	7-3	9-2	11-3	13-0
	Spruce-pine-fir	#2	5-3	7-8	9-9	11-11	13-10	5-0	7-3	9-2	11-3	13-0
	Spruce-pine-fir	#3	4-0	5-10	7-4	9-0	10-5	3-9	5-6	6-11	8-6	9-10

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780 CMR TABLE 5802.5.1(8) - continued
RAFTER SPANS FOR 70 PSF GROUND SNOW LOAD
(Ceiling attached to rafters, $L/\Delta = 240$)

RAFTER SPACING (inches)	SPECIES AND GRADE	DEAD LOAD = 10 psf					DEAD LOAD = 20 psf					
		2 x 4	2 x 6	2 x 8	2 x 10	2 x 12	2 x 4	2 x 6	2 x 8	2 x 10	2 x 12	
		Maximum rafter spans ^a										
		(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	
24	Douglas fir-larch	SS	5-5	8-7	11-3	13-9	15-11	5-5	8-4	10-7	12-11	15-0
	Douglas fir-larch	#1	5-0	7-4	9-4	11-5	13-2	4-9	6-11	8-9	10-9	12-5
	Douglas fir-larch	#2	4-8	6-11	8-9	10-8	12-4	4-5	6-6	8-3	10-0	11-8
	Douglas fir-larch	#3	3-7	5-2	6-7	8-1	9-4	3-4	4-11	6-3	7-7	8-10
	Hem-fir	SS	5-2	8-1	10-8	13-6	13-11	5-2	8-1	10-5	12-4	12-4
	Hem-fir	#1	4-11	7-2	9-1	11-1	12-10	4-7	6-9	8-7	10-6	12-2
	Hem-fir	#2	4-8	6-9	8-7	10-6	12-2	4-4	6-5	8-1	9-11	11-6
	Hem-fir	#3	3-7	5-2	6-7	8-1	9-4	3-4	4-11	6-3	7-7	8-10
	Southern pine	SS	5-4	8-5	11-1	14-2	17-2	5-4	8-5	11-1	14-2	17-2
	Southern pine	#1	5-3	8-3	10-5	12-5	14-9	5-3	7-10	9-10	11-8	13-11
	Southern pine	#2	5-0	7-3	9-4	11-1	13-0	4-9	6-10	8-9	10-6	12-4
	Southern pine	#3	3-9	5-7	7-1	8-5	10-0	3-7	5-3	6-9	7-11	9-5
	Spruce-pine-fir	SS	5-0	7-11	10-5	12-9	14-9	5-0	7-9	9-10	12-0	12-11
	Spruce-pine-fir	#1	4-8	6-11	8-9	10-8	12-4	4-5	6-6	8-3	10-0	11-8
	Spruce-pine-fir	#2	4-8	6-11	8-9	10-8	12-4	4-5	6-6	8-3	10-0	11-8
	Spruce-pine-fir	#3	3-7	5-2	6-7	8-1	9-4	3-4	4-11	6-3	7-7	8-10

Check sources for availability of lumber in lengths greater than 20 feet.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kN/m².

- a. The tabulated rafter spans assume that ceiling joists are located at the bottom of the attic space or that some other method of resisting the outward push of the rafters on the bearing walls, such as rafter ties, is provided at that location. When ceiling joists or rafter ties are located higher in the attic space, the rafter spans shall be multiplied by the factors given below:

H_C/H_R	Rafter Span Adjustment Factor
2/3 or greater	0.50
1/2	0.58
1/3	0.67
1/4	0.76
1/5	0.83
1/6	0.90
1/7.5 and less	1.00

where: H_C = Height of ceiling joists or rafter ties measured vertically above the top of the rafter support walls. H_R = Height of roof ridge measured vertically above the top of the rafter support walls.

780 CMR TABLE 5802.5.1(9)
RAFTER/CEILING JOIST HEEL JOINT CONNECTIONS^{a,b,c,d,e,f}

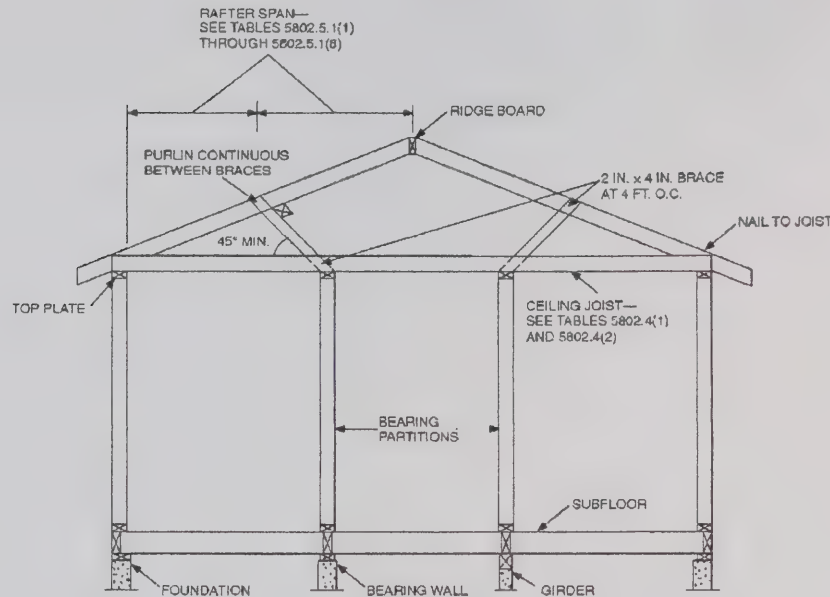
RAFTER SLOPE	RAFTER SPACING (inches)	GROUND SNOW LOAD (psf)											
		30				50				70			
		Roof span (feet)											
		12	20	28	36	12	20	28	36	12	20	28	36
		Required number of 16d common nails ^{a,b} per heel joint splices ^{c,d,e,f}											
3:12	12	4	6	8	11	5	8	12	15	6	11	15	20
	16	5	8	11	14	6	11	15	20	8	14	20	26
	24	7	11	16	21	9	16	23	30	12	21	30	39
4:12	12	3	5	6	8	4	6	9	11	5	8	12	15
	16	4	6	8	11	5	8	12	15	6	11	15	20
	24	5	9	12	16	7	12	17	22	9	16	23	29
5:12	12	3	4	5	7	3	5	7	9	4	7	9	12
	16	3	5	7	9	4	7	9	12	5	9	12	16
	24	4	7	10	13	6	10	14	18	7	13	18	23
7:12	12	3	3	4	5	3	4	5	7	3	5	7	9
	16	3	4	5	6	3	5	7	9	4	6	9	11
	24	3	5	7	9	4	7	10	13	5	9	13	17
9:12	12	3	3	3	4	3	3	4	5	3	4	5	7
	16	3	3	4	5	3	4	5	7	3	5	7	9
	24	3	4	6	7	3	6	8	10	4	7	10	13
12:12	12	3	3	3	3	3	3	3	4	3	3	4	5
	16	3	3	3	4	3	3	4	5	3	4	5	7
	24	3	3	4	6	3	4	6	8	3	6	8	10

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kN/m².

- 40d box nails shall be permitted to be substituted for 16d common nails.
- Nailing requirements shall be permitted to be reduced 25% if nails are clinched.
- Heel joint connections are not required when the ridge is supported by a load-bearing wall, header or ridge beam.
- When intermediate support of the rafter is provided by vertical struts or purlins to a load bearing wall, the tabulated heel joint connection requirements shall be permitted to be reduced proportionally to the reduction in span.
- Equivalent nailing patterns are required for ceiling joist to ceiling joist lap splices.
- When rafter ties are substituted for ceiling joists, the heel joint connection requirement shall be taken as the tabulated heel joint connection requirement for $\frac{2}{3}$ of the actual rafter-slope.

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**780 CMR FIGURE 5802.5.1
BRACED RAFTER CONSTRUCTION**



For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 degree = 0.018 rad.

NOTE: Where ceiling joints run perpendicular to the rafters, rafter ties shall be nailed to the rafter near the plate line and spaced not more than four feet on center.

**780CMR TABLE 5802.11
REQUIRED STRENGTH OF TRUSS OR RAFTER CONNECTIONS
TO RESIST WIND UPLIFT FORCES^{a,b,c,e,f}
(Pounds per connection)**

BASIC WIND SPEED (3-second gust)	ROOF SPAN (feet)							OVERHANGS ^d (pounds/feet)
	12	20	24	28	32	36	40	
85	-72	-120	-145	-169	-193	-217	-241	-38.55
90	-91	-151	-181	-212	-242	-272	-302	-43.22
100	-131	-218	-262	-305	-349	-393	-436	-53.36
110	-175	-292	-351	-409	-467	-526	-584	-64.56

For SI: 1 inch = 25.4 mm, 1 foot = 305 mm, 1 mph = 1.61 km/hr, 1 pound/foot = 14.5939 N/m, 1 pound = 0.454 kg.

- The uplift connection requirements are based on a 30 foot mean roof height located in Exposure B. For Exposures C and D and for other mean roof heights, multiply the above loads by the Adjustment Coefficients in 780 CMR Table 5301.2(3).
- The uplift connection requirements are based on the framing being spaced 24 inches on center. Multiply by 0.67 for framing spaced 16 inches on center and multiply by 0.5 for framing spaced 12 inches on center.
- The uplift connection requirements include an allowance for ten pounds of dead load.
- The uplift connection requirements do not account for the effects of overhangs. The magnitude of the above loads shall be increased by adding the overhang loads found in the table. The overhang loads are also based on framing spaced 24 inches on center. The overhang loads given shall be multiplied by the overhang projection and added to the roof uplift value in the table.
- The uplift connection requirements are based upon wind loading on end zones as defined in Section M1609.6 of the *International Building Code*. Connection loads for connections located a distance of 20% of the least horizontal dimension of the building from the corner of the building are permitted to be reduced by multiplying the table connection value by 0.7 and multiplying the overhang load by 0.8.
- For wall-to-wall and wall-to-foundation connections, the capacity of the uplift connector is permitted to be reduced by 100 pounds for each full wall above. (For example, if a 600-pound rated connector is used on the roof framing, a 500-pound rated connector is permitted at the next floor level down.)

5802.10.5 Truss to Wall Connection. Trusses shall be connected to wall plates by the use of approved connectors having a resistance to uplift of not less than 175 pounds (79.45 kg.) and shall be installed in accordance with the manufacturer's specifications. For roof assemblies subject to wind uplift pressures of 20 pounds per square foot (0.958 kN/m²) or greater, as established in 780 CMR Table 5301.2(2), adjusted for height and exposure per 780 CMR Table 5301.2(3), *see* 780 CMR 5802.11.

5802.11 Roof tie-down.

5802.11.1 Uplift Resistance. Roof assemblies which are subject to wind uplift pressures of 20 pounds per square foot (0.958 kN/m²) or greater shall have roof rafters or trusses attached to their supporting wall assemblies by connections capable of providing the resistance required in 780 CMR Table 5802.11. Wind uplift pressures shall be determined using an effective wind area of 100 square feet (9.3 m²) and *the applicable wind zone* in 780 CMR Table 5301.2(2), as adjusted for height and exposure per 780 CMR Table 5301.2(3).

A continuous load path shall be provided to transmit the uplift forces from the rafter or truss ties to the foundation.

780 CMR 5803 ROOF SHEATHING

5803.1 Lumber Sheathing. Allowable spans for lumber used as roof sheathing shall conform to 780 CMR Table 5803.1. Spaced lumber sheathing for wood shingle and shake roofing shall conform to the requirements of 780 CMR 5905.7 and 5905.8.

780 CMR TABLE 5803.1
MINIMUM THICKNESS OF
LUMBER ROOF SHEATHING

RAFTER OR BEAM SPACING (inches)	MINIMUM NET THICKNESS (inches)
24	5/8
48 ^a	1½T & G
60 ^b	
72 ^c	

For SI: 1 inch = 25.4 mm.

a. Minimum 270 F_b , 340,000 E .

b. Minimum 420 F_b , 660,000 E .

c. Minimum 600 F_b , 1,150,000 E .

5803.2 Wood Structural Panel Sheathing.

5803.2.1 Identification and Grade. Wood structural panels shall conform to DOC PS 1, DOC PS 2 or, when manufactured in Canada, CSA 0437, and shall be identified by grade mark or certificate of inspection issued by an approved agency. Wood structural panels shall comply with the grades specified in 780 CMR Table 5503.2.1.1(1).

5803.2.1.1 Exposure Durability. All wood structural panels, when designed to be permanently exposed in outdoor applications,

shall be of an exterior exposure durability. Wood structural panel roof sheathing exposed to the underside may be of interior type bonded with exterior glue, identified as Exposure 1.

5803.2.1.2 Fire-retardant-treated Plywood.

The allowable unit stresses for fire-retardant-treated plywood, including fastener values, shall be developed from an approved method of investigation that considers the effects of anticipated temperature and humidity to which the fire-retardant-treated plywood will be subjected, the type of treatment and redrying process. The fire-retardant-treated plywood shall be graded by an approved agency.

5803.2.2 Allowable Spans. The maximum allowable spans for wood structural panel roof sheathing shall not exceed the values set forth in 780 CMR Table 5503.2.1.1(1).

5803.2.3 Installation. Wood structural panel used as roof sheathing shall be installed with joints staggered or nonstaggered in accordance with 780 CMR Table 5602.3(1), or APA E30 for wood roof framing or with 780 CMR Table 5804.3 for steel roof framing.

780 CMR 5804 STEEL ROOF FRAMING

5804.1 General. Elements shall be straight and free of any defects that would significantly affect their structural performance. Cold-formed steel roof framing members shall comply with the requirements of 780 CMR 5804.1.

5804.1.1 Applicability Limits. The provisions of 780 CMR 5804.1 shall control the construction of steel roof framing for buildings not greater than 60 feet (18 288 mm) in length perpendicular to the joist, rafter or truss span, not greater than 36 feet (10 973 mm) in width parallel to the joist span or truss, not greater than two stories in height with each story not greater than ten feet (3048 mm) high, and roof slopes not smaller than 3:12 (25% slope) or greater than 12:12 (100% slope). Steel roof framing constructed in accordance with the provisions of 780 CMR 5804.1 shall be limited to sites subjected to a maximum design wind speed of 110 miles per hour (209 km/h) Exposure A, B or C and a maximum ground snow load of 70 psf (3.35 kN/m²).

5804.1.2 In-line Framing. Steel roof framing constructed in accordance with 780 CMR 5804 shall be located directly in-line with load-bearing studs below with a maximum tolerance of ¼ inch (19.1 mm) between the centerline of the stud and roof joist/rafter.

5804.1.3 Roof trusses. The design, quality assurance, installation and testing of cold-formed steel trusses shall be in accordance with the AISI Standard for Cold-formed Steel Framing-Truss Design (COFS/Truss).

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5804.2 Structural Framing. Load-bearing steel roof framing members shall comply with 780 CMR Figure 5804.2(1) and the dimensional and minimum thickness requirements specified in 780 CMR Tables 5804.2(1) and 5804.2(2). Tracks shall comply with 780 CMR Figure 5804.2(2) and shall have a minimum flange width of 1¼ inches (32 mm). The maximum inside bend radius for load-bearing members shall be the greater of 3/32 inch (2.4 mm) or twice the uncoated steel thickness. Holes in roof framing members shall not exceed 1.5 inches (38 mm) in width or four inches (102 mm) in length as shown in 780 CMR Figure 5804.2(3). Holes shall be permitted only along the centerline of the web of the framing member. Holes shall not be less than 24 inches (610 mm) center-to-center and shall not be located less than ten inches (254 mm) from the edge of the hole to the edge of the bearing surface or support unless patched in accordance with 780 CMR 5804.3.6.

5804.2.1 Material. Load-bearing steel framing members shall be cold-formed to shape from structural quality sheet steel complying with the requirements of one of the following:

1. ASTM A 653; Grades 33, 37, 40 and 50 (Classes 1 and 3).
2. ASTM A 792; Grades 33, 37, 40 and 50A.
3. ASTM A 875; Grades 33, 37, 40 and 50 (Classes 1 and 3).
4. Steels that comply with ASTM A 653, except for tensile and elongation, shall be permitted provided the ratio of tensile strength to yield point is at least 1.08 and the total elongation is at least 10% for a two-inch (51

mm) gage length or 7% for an 8-inch (203 mm) gage length.

5804.2.2 Identification. Load-bearing steel framing members shall have a legible label, stencil, stamp or embossment with the following information as a minimum:

1. Manufacturer's identification.
2. Minimum uncoated steel thickness in inches (mm).
3. Minimum coating designation.
4. Minimum yield strength, in kips per square inch (ksi).

5804.2.3 Fastening Requirements. Screws for steel-to-steel connections shall be installed with a minimum edge distance and center-to-center spacing of ½ inch (12.7 mm), shall be self-drilling tapping, and shall conform to SAE J78. Structural sheathing shall be attached to roof rafters with minimum No. 8 self-drilling tapping screws that conform to SAE J78. Screws for attaching structural sheathing to steel roof framing shall have a minimum head diameter of 0.292 inch (7.4mm) with countersunk heads and shall be installed with a minimum edge distance of ¾ inch (9.5 mm). Gypsum board ceilings shall be attached to steel joists with minimum No. 6 screws conforming to ASTM C 954 and shall be installed in accordance with 780 CMR 5805. For all connections, screws shall extend through the steel a minimum of three exposed threads. All self-drilling tapping screws conforming to SAE J78 shall have a minimum Type II coating in accordance with ASTM B 633.

780 CMR TABLE 5804.2(1)
LOAD-BEARING COLD-FORMED STEEL MEMBER SIZES

NOMINAL MEMBER SIZE MEMBER DESIGNATION*	WEB DEPTH (inches)	MINIMUM FLANGE WIDTH (inches)	MAXIMUM FLANGE WIDTH (inches)	MINIMUM LIP SIZE (inches)
350S162-t	3.5	1.625	2	0.5
550S162-t	5.5	1.625	2	0.5
800S162-t	8	1.625	2	0.5
1000S162-t	10	1.625	2	0.5
1200S162-t	12	1.625	2	0.5

For SI: 1 inch = 25.4 mm.

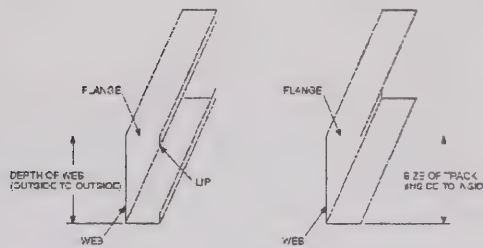
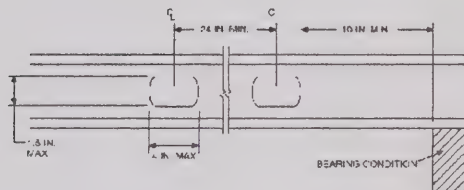
- a. The member designation is defined by the first number representing the member depth in 1/100 inch, the letter "s" representing a stud or joist member, the second number representing the flange width in 1/100 inch, and the letter "t" shall be a number representing the minimum base metal thickness in mils [see 780CMR Table 5804.2(2)].

780 CMR TABLE 5804.2(2)
MINIMUM THICKNESS OF COLD-FORMED STEEL ROOF FRAMING MEMBERS

DESIGNATION (mils)	MINIMUM UNCOATED THICKNESS (inches)	REFERENCED GAGE NUMBER
33	0.033	20
43	0.043	18
54	0.054	16
68	0.068	14

For SI: 1 inch = 25.4 mm, 1 mil = 0.0254 mm.

780 CMR

FIGURE 5804.2(1)
C-SECTIONFIGURE 5804.2(2)
TRACK SECTION780 CMR FIGURE 5804.2(3)
WEB HOLES

For SI: 1 inch = 25.4 mm.

Where No. 8 screws are specified in a steel-to-steel connection, the required number of screws in the connection is permitted to be reduced in accordance with the reduction factors in 780 CMR Table 5804.2.3 when larger screws are used or when one of the sheets of steel being connected is thicker than 33 mils (0.84mm). When applying the reduction factor, the resulting number of screws shall be rounded up.

780 CMR TABLE 5804.2.3
SCREW SUBSTITUTION FACTOR

SCREW SIZE	THINNEST CONNECTED STEEL SHEET (mils)	
	33	43
#8	1	0.67
#10	0.93	0.62
#12	0.86	0.56

For SI: 1 mil = 0.0254 mm.

5804.3 Roof Construction. Steel roof systems constructed in accordance with the provisions of 780 CMR 5804.3 shall consist of both ceiling joists and rafters in accordance with 780 CMR Figure 5804.3 and fastened in accordance with 780 CMR Table 5804.3.

5804.3.1 Allowable Ceiling Joist Spans. The clear span of cold-formed steel ceiling joists shall not exceed the limits set forth in 780CMR Table

5804.3.1(1) or 5804.3.1(2). Ceiling joists shall have a minimum bearing length of 1.5 inches (38 mm) and shall be connected to rafters (heel joint) in accordance with 780 CMR Figure 5804.3.1(1) and 780CMR Table 5804.3.1(3). When continuous joists are framed across interior bearing supports, the interior bearing supports shall be located within 24 inches (610 mm) of midspan of the ceiling joist, and the individual spans shall not exceed the applicable spans in 780 CMR Table 5804.3.1(1) or 5804.3.1(2). Where required in 780 CMR Table 5804.3.1(1) or 5804.3.1(2), bearing stiffeners shall be installed at each bearing location in accordance with 780 CMR 5804.3.8 and 780 CMR Figure 5804.3.8. When the attic is to be used as an occupied space, the ceiling joists shall be designed in accordance with 780 CMR 5505.

5804.3.2 Ceiling Joist Bracing. The bottom flanges of steel ceiling joists shall be laterally braced in accordance with 780 CMR 5702. The top flanges of steel ceiling joists shall be laterally braced with a minimum of 33 mil (0.84 mm) C-section, 33 mil (0.84mm) track section, or 1½ inch by 33 mil (38 mm by 0.84 mm) continuous steel strapping as required in 780 CMR Table 5804.3.1(1) or 5804.3.1(2). Lateral bracing shall be installed in accordance with 780 CMR Figure

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5804.3. C-section, tracks or straps shall be fastened to the top flange at each joist with at least one No. 8 screw and shall be fastened to blocking with at least two No. 8 screws. Blocking or bridging (X-bracing) shall be installed between joists in-line with strap bracing at a maximum spacing of 12 feet (3658 mm) measured perpendicular to the joists, and at the termination of all straps. The third point bracing span values from 780 CMR Table 5804.3.1(1) or 5804.3.1(2) shall be used for straps installed at closer spacings than third point bracing, or when sheathing is applied to the top of the ceiling joists.

5804.3.3 Allowable Rafter Spans. The horizontal projection of the rafter span, as shown in 780 CMR Figure 5804.3, shall not exceed the limits set forth in 780 CMR Table 5804.3.3(1). Wind speeds shall be converted to equivalent ground snow loads in accordance with 780 CMR Table 5804.3.3(2). Rafter spans shall be selected based on the higher of the ground snow load or the equivalent snow load converted from the wind speed. When required, a rafter support brace shall be a minimum of 350S162-33 C-section with maximum length of eight feet (2438 mm) and shall be connected to a ceiling joist and rafter with four No. 10 screws at each end.

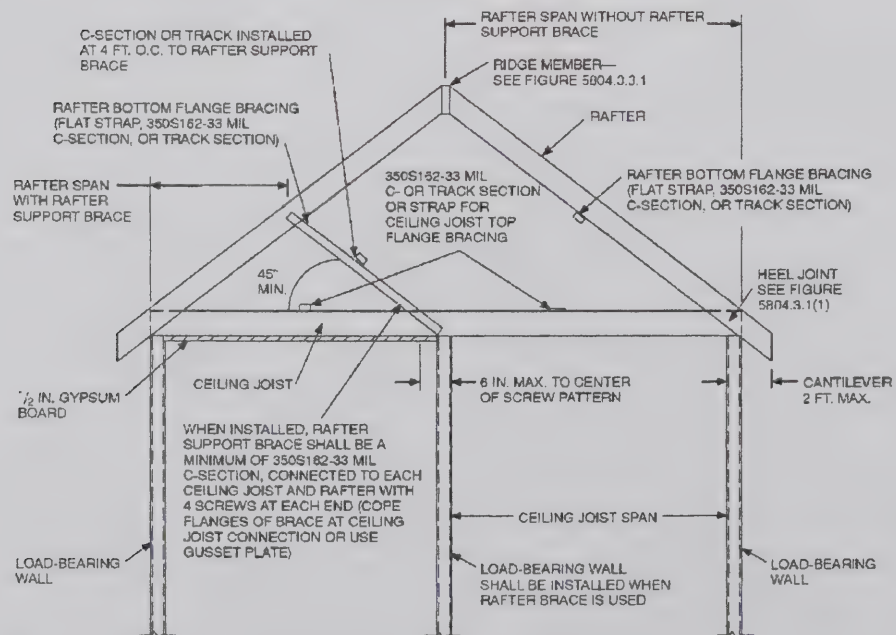
780 CMR TABLE 5804.3
ROOF FRAMING FASTENING SCHEDULE^{a,b}

DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND SIZE OF FASTENERS	SPACING OF FASTENERS
Ceiling joist to top track of load-bearing wall	2 No. 10 screws	Each joist
Roof sheathing (oriented strand board or plywood) to rafter	No. 8 screws	6" o.c. on edges and 12" o.c. at interior supports 6" o.c. at gable end truss
Truss to bearing wall ^a	2 No. 10 screws	Each truss
Gable end truss to endwall top track	No. 10 screws	12" o.c.
Rafter to ceiling joist	Minimum No. 10 screws, per 780 CMR Table 5804.3.1(3)	Evenly spaced, less than ½" from all edges.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kN/m², 1 mil = 0.0254 mm.

- Screws shall be applied through the flanges of the truss or ceiling joist or a 54 mil clip angle shall be used with two No. 10 screws in each leg. See 780 CMR 5804.4 for additional requirements to resist uplift forces.
- Spacing of fasteners on roof sheathing panel edges applies to panel edges supported by framing members and at all roof plane perimeters. Blocking of roof sheathing panel edges perpendicular to the framing members shall not be required except at the intersection of adjacent roof planes. Roof perimeter shall be supported by framing members or cold-formed blocking of the same depth and gauge as the floor members.

780 CMR FIGURE 5804.3
STEEL ROOF CONSTRUCTION



For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm.

780 CMR TABLE 5804.3.1 (1)
ALLOWABLE SPANS FOR COLD-FORMED STEEL CEILING JOISTS^{a,b,c}
10 psf live load (no attic storage)

NOMINAL JOIST SIZE	LATERAL SUPPORT OF TOP (COMPRESSION) FLANGE					
	Unbraced		Mid-span bracing		Third-point bracing	
	Spacing (inches)		Spacing (inches)		Spacing (inches)	
	16	24	16	24	16	24
350S162-33	9'-2"	8'-3"	11'-9"	10'-1"	11'-9"	10'-4"
350S162-43	9'-11"	8'-10"	12'-10"	11'-2"	12'-10"	11'-2"
350S162-54	10'-8"	9'-6"	13'-9"	12'-0"	13'-9"	12'-0"
350S162-68	11'-7"	10'-4"	14'-8"	12'-10"	14'-8"	12'-10"
550S162-33	10'-5"	9'-5"	14'-5"	12'-8" ^{nc}	16'-4"	13'-10" ^{nc}
550S162-43	11'-2"	10'-1"	15'-7"	13'-10"	18'-0"	15'-5"
550S162-54	12'-0"	10'-9"	16'-7"	14'-9"	19'-5"	16'-8"
550S162-68	12'-11"	11'-7"	17'-8"	15'-10"	20'-11"	18'-1"
800S162-33	11'-8" ^{nc}	10'-6" ^{nc}	16'-5" ^{nc}	14'-9" ^{nc}	19'-5" ^{nc}	16'-7" ^{nc}
800S162-43	12'-6"	11'-3"	17'-6"	15'-10"	21'-2"	18'-7"
800S162-54	13'-4"	11'-11"	18'-7"	16'-9"	22'-7"	20'-0"
800S162-68	14'-3"	12'-9"	19'-8"	17'-8"	23'-11"	21'-4"
1000S162-43	13'-4" ^{nc}	12'-1" ^{nc}	18'-9" ^{nc}	16'-11" ^{nc}	22'-11" ^{nc}	20'-6" ^{nc}
1000S162-54	14'-2"	12'-9"	19'-10"	17'-10"	24'-2"	21'-9"
1000S162-68	15'-2"	13'-7"	21'-0"	18'-11"	25'-6"	23'-0"
1200S162-43	14'-1" ^{nc}	12'-8" ^{nc}	19'-10" ^{nc}	17'-11" ^{nc}	24'-3" ^{nc}	21'-6" ^{nc}
1200S162-54	15'-0" ^{nc}	13'-5" ^{nc}	20'-11" ^{nc}	18'-11" ^{nc}	25'-7" ^{nc}	23'-1" ^{nc}
1200S162-68	15'-11"	14'-4"	22'-2"	19'-11"	27'-0"	24'-4"

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kN/m².

a. Deflection criteria: 1/240 for total loads.

b. Ceiling dead load = 5 psf.

c. Bearing stiffeners are required at all bearing points and concentrated load locations.

TABLE 5804.3.1(2)
ALLOWABLE SPANS FOR COLD-FORMED STEEL CEILING JOISTS^{a,b,c}
20 psf live load (Limited attic storage where development of future rooms is not possible)

NOMINAL JOIST SIZE	LATERAL SUPPORT OF TOP FLANGE					
	Unbraced		Mid-span bracing		Third-point bracing	
	Spacing (inches)		Spacing (inches)		Spacing (inches)	
	16	24	16	24	16	24
350S 162-33	8'-0"	6'-0"	9'-8"	6'-0"	9'-0"	6'-0"
350S162-43	8'-8"	7'-8"	10'-9"	9'-1"	10'-10"	9'-5"
350S162-54	9'-3"	8'-3"	11'-7"	9'-11"	11'-7"	10'-1"
350S162-68	10'-0"	8'-11"	12'-5"	10'-10"	12'-5"	10'-10"
550S162-33	9'-2"	6'-0"	12'-2" ^{nc}	10'-5" ^{nc}	13'-3"	11'-0" ^{nc}
550S162-43	9'-10"	8'-10"	13'-4"	11'-6"	14'-9"	12'-5"
550S162-54	10'-5"	9'-5"	14'-4"	12'-6"	16'-1"	13'-7"
550S162-68	11'-3"	10'-0"	15'-4"	13'-5"	17'-5"	14'-10"
800S162-33	10'-3" ^{nc}	9'-3" ^{nc}	14'-4" ^{nc}	12'-5" ^{nc}	15'-11" ^{nc}	13'-4" ^{nc}
800S162-43	10'-11"	9'-10"	15'-5"	13'-8" ^{nc}	17'-11" ^{nc}	15'-5" ^{nc}
800S162-54	11'-8"	10'-6"	16'-3"	14'-7"	19'-3"	16'-8"
800S162-68	12'-5"	11'-2"	17'-3"	15'-6"	20'-7"	18'-0"
1000S162-43	11'-9"	10'-7" ^{nc}	16'-6" ^{nc}	14'-10" ^{nc}	19'-10" ^{nc}	17'-1" ^{nc}
1000S162-54	12'-5"	11'-2"	17'-5"	15'-8"	21'-1"	18'-7"
1000S162-68	13'-3"	11'-10"	18'-5"	16'-7"	22'-4"	19'-11"
1200S162-43	12'-5" ^{nc}	11'-2" ^{nc}	17'-5" ^{nc}	15'-8" ^{nc}	20'-9" ^{nc}	18'-0" ^{nc}
1200S162-54	13'-1" ^{nc}	11'-9" ^{nc}	18'-5" ^{nc}	16'-7" ^{nc}	22'-5" ^{nc}	20'-1" ^{nc}
1200S162-68	13'-11"	12'-6"	19'-5"	17'-6"	23'-8"	21'-3"

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kN/m².

a. Deflection criteria: 1/240 for total loads.

b. Ceiling dead load = 5 psf.

c. Bearing stiffeners are required at all bearing points and concentrated load locations.

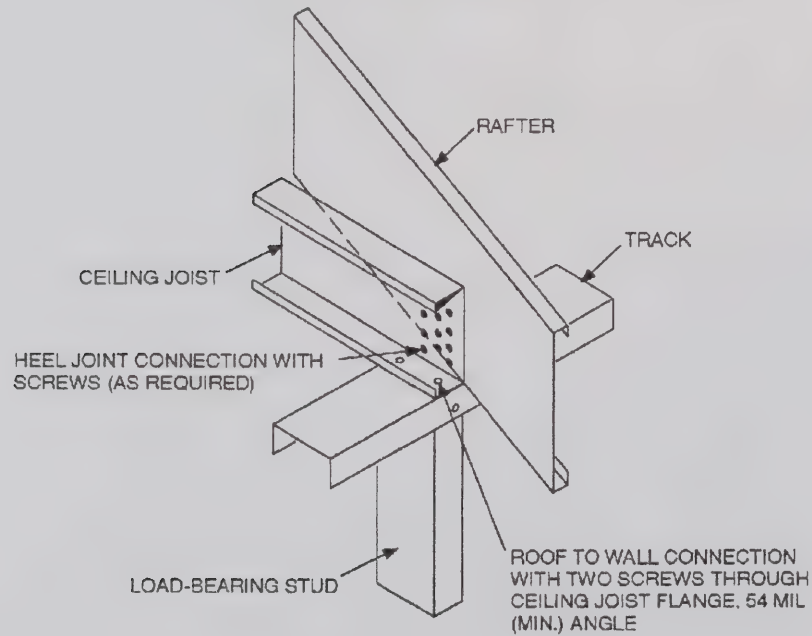
780 CMR TABLE 5804.3.1(3)
NUMBER OF SCREWS REQUIRED FOR CEILING JOIST TO RAFTER CONNECTION^a

ROOF SLOPE	BUILDING WIDTH (feet)															
	24				28				32				36			
	Ground snow load (psf)				Ground snow load (psf)				Ground snow load (psf)				Ground snow load (psf)			
	20	30	50	70	20	30	50	70	20	30	50	70	20	30	50	70
3:12	5	6	9	12	6	7	10	13	7	8	12	15	8	9	13	17
4:12	4	5	7	9	5	6	8	10	6	6	9	12	6	7	10	13
5:12	4	4	6	7	4	5	7	9	5	5	8	10	5	6	9	11
6:12	3	4	5	7	4	4	6	8	4	5	7	9	4	5	7	10
7:12	3	3	5	6	3	4	5	7	4	4	6	8	4	5	7	9
8:12	3	3	4	5	3	3	5	6	3	4	5	7	4	4	6	8
9:12	2	3	4	5	3	3	4	6	3	4	5	6	3	4	6	7
10:12	2	3	4	5	3	3	4	5	3	3	5	6	3	4	5	7
11:12	2	3	4	4	3	3	4	5	3	3	5	6	3	4	5	6
12:12	2	3	3	4	2	3	4	5	3	3	4	6	3	4	5	6

For SI: 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kN/m².

a. Screws shall be No. 10 minimum.

780 CMR FIGURE 5804.3.1(1)
JOIST TO RAFTER CONNECTION



For SI: 1 mil = 0.0254 mm.

780 CMR TABLE 5804.3.3(1)
ALLOWABLE HORIZONTAL RAFTER SPANS^{a,b}

NOMINAL RAFTER SIZE	GROUND SNOW LOAD							
	20 psf		30 psf		50 psf		70 psf	
	Spacing (inches-feet)		Spacing (inches-feet)		Spacing (inches-feet)		Spacing (inches-feet)	
	16	24	16	24	16	24	16	24
550S162-33	12'-8"	10'-4"	11'-9"	9'-7"	9'-11"	8'-1"	8'-10"	7'-2"
550S162-43	15'-5"	12'-7"	14'-3"	11'-8"	12'-1"	9'-10"	10'-8"	8'-9"
550S162-54	13'-0"	14'-2"	16'-1"	13'-1"	13'-8"	11'-2"	12'-1"	9'-10"
550S162-68	18'-1"	15'-10"	17'-3"	14'-9"	15'-4"	12'-6"	13'-6"	11'-1"
800S162-33	15'-5"	11'-5"	14'-4"	9'-10"	10'-7"	7'-1"	8'-3"	5'-6"
800S162-43	19'-1"	15'-7"	17'-9"	14'-6"	15'-1"	12'-3"	13'-3"	10'-9"
800S162-54	22'-7"	18'-5"	21'-0"	17'-1"	17'-9"	14'-6"	15'-9"	12'-10"
800S162-68	24'-7"	20'-9"	23'-4"	19'-3"	20'-0"	16'-4"	17'-8"	14'-5"
1000S162-43	21'-2"	17'-3"	19'-8"	16'-0"	16'-8"	13'-1"	14'-9"	10'-3"
1000S162-54	25'-1"	20'-6"	23'-3"	19'-0"	19'-9"	16'-1"	17'-5"	14'-3"
1000S162-68	29'-6"	24'-6"	27'-9"	22'-9"	23'-8"	19'-3"	21'-0"	17'-1"
1200S162-43	23'-0"	18'-2"	21'-4"	15'-7"	16'-9"	11'-3"	13'-2"	8'-9"
1200S162-54	27'-3"	22'-3"	25'-3"	20'-7"	21'-5"	17'-6"	18'-11"	15'-5"
1200S162-68	32'-1"	26'-2"	29'-9"	24'-3"	25'-3"	20'-7"	22'-4"	18'-2"

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kN/m².

a. Deflection criteria: 1/240 for live loads and 1/180 for total loads.

b. Roof dead load = 12 pounds per square foot.

780 CMR TABLE 5804.3.3(2)
BASIC WIND SPEED TO EQUIVALENT SNOW LOAD CONVERSION

BASIC WIND SPEED AND EXPOSURE		EQUIVALENT GROUND SNOW LOAD (psf)									
		Roof slope									
Exp. A/B	Exp. C	3:12	4:12	5:12	6:12	7:12	8:12	9:12	10:12	11:12	12:12
85 mph	—	20	20	20	20	20	20	30	30	30	30
100 mph	85 mph	20	20	20	20	30	30	30	30	50	50
110 mph	100 mph	20	20	20	20	30	50	50	50	50	50
—	110 mph	30	30	30	50	50	50	70	70	70	—

For SI: 1 mile per hour = 0.447 m/s, 1 pound per square foot = 0.0479 kN/m².

5804.3.3.1 Rafter Framing. Rafters shall be connected to a parallel ceiling joist to form a continuous tie between exterior walls in accordance with 780 CMR Figures 5804.3 and 5804.3.1(1) and 780 CMR Table 5804.3.1(3). Rafters shall be connected to a ridge member with a minimum two-inch by two-inch (51 mm by 51 mm) clip angle fastened with minimum No. 10 screws to the ridge member in accordance with 780 CMR Figure 5804.3.3.1 and 780 CMR Table 5804.3.3.1. The clip angle shall have a minimum steel thickness as the rafter member and shall extend the full depth of the rafter member. The ridge member shall be fabricated from a C-section and a track section, which shall be of a minimum size and steel thickness as the adjacent rafters and shall be installed in accordance with 780 CMR Figure 5804.3.3.1.

5804.3.3.2 Roof Cantilevers. Roof cantilevers shall not exceed 24 inches (610 mm) in accordance with 780 CMR Figure 5804.3. Roof cantilevers shall be supported by a header in accordance with 780 CMR 5603.6 or shall be supported by the floor framing in accordance with 780 CMR 5505.3.7.

5804.3.4 Rafter Bottom Flange Bracing. The bottom flanges of steel rafters shall be continuously braced with a minimum 33-mil (0.84 mm) C-section, 33-mil (0.84 mm) track section, or a 1½-inch by 33-mil (38 mm by 0.84 mm) steel strapping at a maximum spacing of eight feet (2438 mm) as measured parallel to the rafters. Bracing shall be installed in accordance with 780 CMR Figure 5804.3. The C-section, track section, or straps shall be fastened to blocking with at least two No. 8 screws. Blocking or bridging (X-bracing) shall be installed between rafters in-line with the continuous bracing at a maximum spacing of 12 feet (3658 mm) measured perpendicular to the rafters and at the termination of all straps. The ends of continuous bracing shall be fastened to blocking with at least two No. 8 screws.

5804.3.5 Cutting and Notching. Flanges and lips of load-bearing steel roof framing members shall not be cut or notched. Holes in webs shall be in accordance with 780 CMR 5804.2.

5804.3.6 Hole Patching. Holes in ceiling joist and rafters with dimensions conforming to 780 CMR 5804.2 that are closer than ten inches (254 mm) from the edge of the hole to the edge of

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bearing surface shall be patched with a solid steel plate, C-section or track section in accordance with 780 CMR Figure 5804.3.6. The steel patch shall be of a minimum thickness as the receiving member and shall extend at least one inch (25.4 mm) beyond all edges of the hole. The steel patch shall be fastened to the web with No. 8 screws (minimum) spaced no greater than one inch (25.4 mm) center-to-center along the edges of the patch, with a minimum edge distance of ½ inch (12.7 mm).

5804.3.7 Splicing. Rafters and other structural members, except ceiling joists, shall not be spliced. Splices in ceiling joists shall only be permitted at interior bearing points and shall be constructed in accordance with 780 CMR Figure 5804.3.7(1). Spliced ceiling joists shall be connected with the same number and size of screws on connection. Splicing of tracks shall conform with 780 CMR Figure 5804.3.7(2).

5804.3.8 Bearing Stiffener. A bearing stiffener shall be fabricated from a minimum 33-mil (0.84 mm) C-section or track section. Each stiffener shall be fastened to the web of the ceiling joist with a minimum of four No. 8 screws equally spaced as shown in 780 CMR Figure 5804.3.8. Stiffeners shall extend across the full depth of the web and shall be installed on either side of the web.

5804.3.9 Headers. Roof-ceiling framing above wall openings shall be supported on headers. The allowable spans for headers in bearing walls shall not exceed the values set forth in 780 CMR Table 5603.6(1).

5804.3.10 Framing of Opening. Openings in roof and ceiling framing shall be framed with headers and trimmers between ceiling joists or rafters. Header joist spans shall not exceed four feet (1219 mm). Header and trimmer joists shall be fabricated from joist and track sections, which shall be of a minimum size and thickness in accordance with 780 CMR Figures 5804.3.10(1) and 5804.3.10(2). Each header joist shall be connected to trimmer joist with a minimum of four two-inch by two-inch (51mm by 51 mm) clip angles. Each clip angle shall be fastened to both the header and trimmer joists with four No. 8 screws, evenly spaced, through each leg of the clip angle. The clip angles shall have a steel thickness not less than that of the floor joist.

5804.4 Roof Tie-down. Roof assemblies subject to wind uplift pressures of 20 pounds per square foot (0.96 kN/m²) or greater, as established in 780 CMR Table 5301.2(2), shall have rafter-to-bearing wall ties provided in accordance with 780 CMR Table 5802.11.

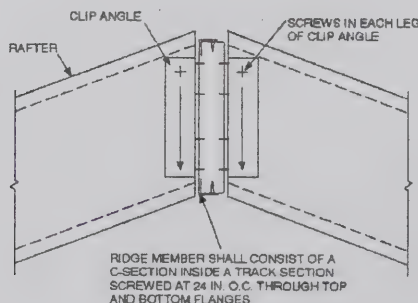
**780 CMR TABLE 5804.3.3.1
NUMBER OF SCREWS REQUIRED AT EACH LEG OF CLIP ANGLE FOR RAFTER
TO RIDGE MEMBER CONNECTION^a**

BUILDING WIDTH (feet)	GROUND SNOW LOAD (psf)			
	0 to 20	21 to 30	31 to 50	51 to 70
24	2	3	4	4
28	2	3	4	5
32	3	3	4	5
36	3	4	5	6

For SI: 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kN/m².

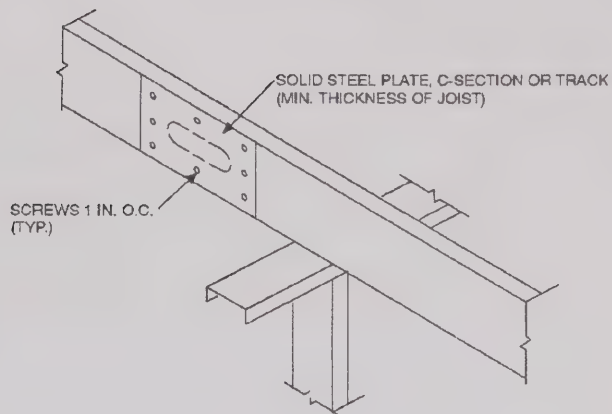
a. Screws shall be No. 10 minimum.

**780 CMR FIGURE 5804.3.3.1
RIDGE BOARD CONNECTION**



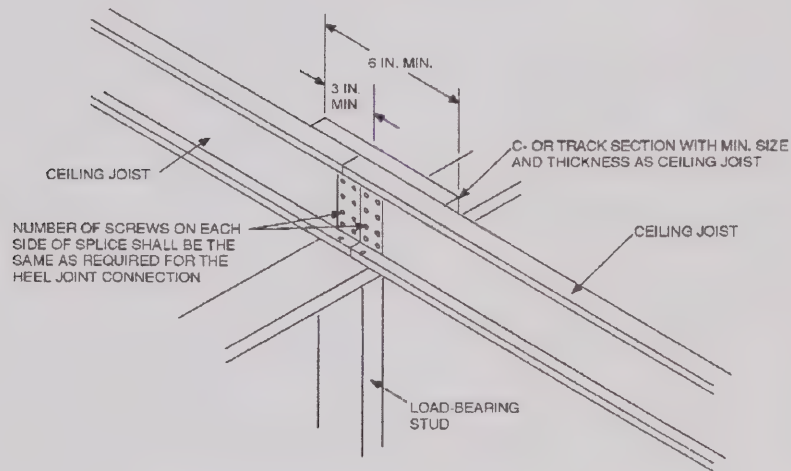
For SI: 1 inch = 25.4 mm.

**780 CMR FIGURE 5804.3.6
HOLE PATCHING**



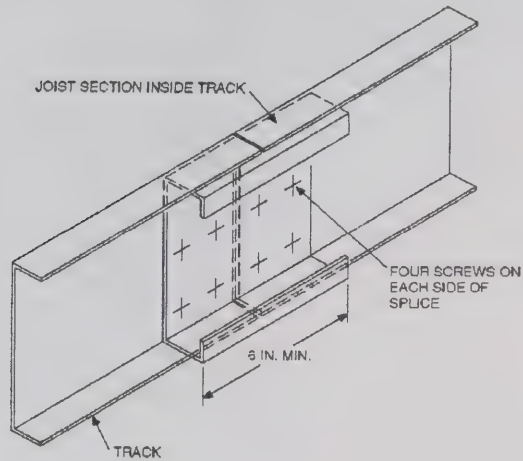
For SI: 1 inch = 25.4 mm.

**FIGURE 5804.3.7(1)
SPliced CEILING JOISTS**



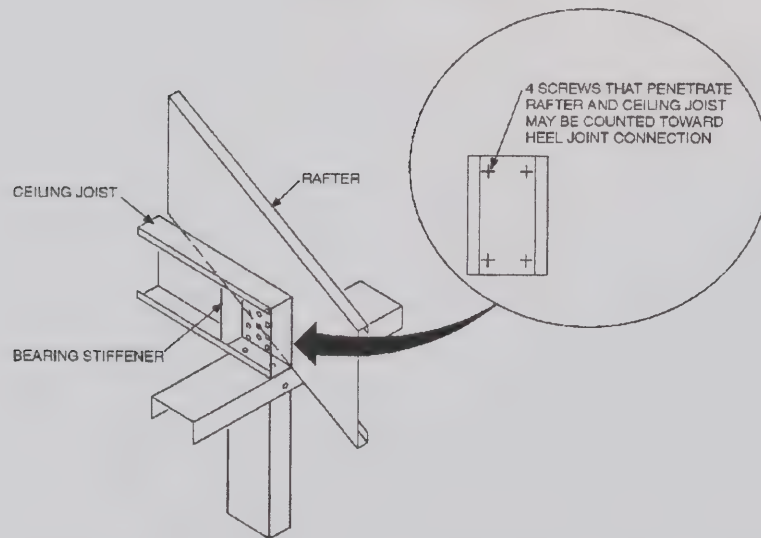
For SI: 1 inch = 25.4 mm.

780 CMR FIGURE 5804.3.7(2)
TRACK SPLICE

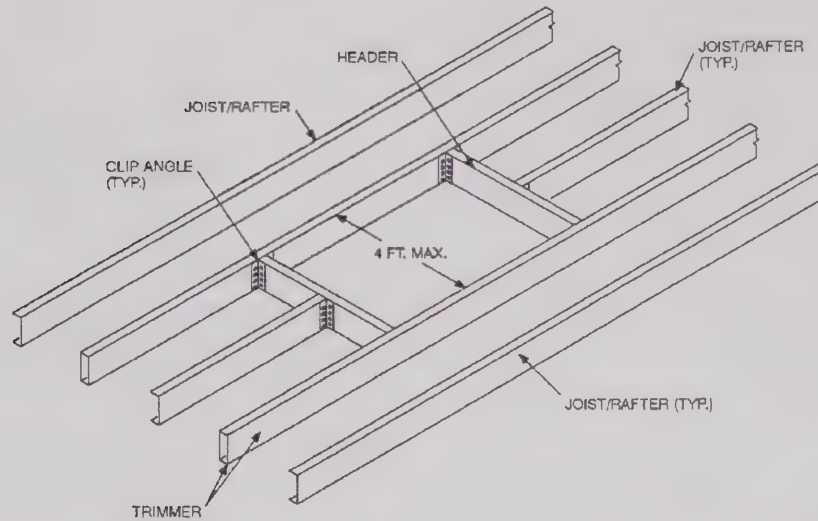


For SI: 1 inch = 25.4 mm.

780 CMR FIGURE 5804.3.8
BEARING STIFFENER

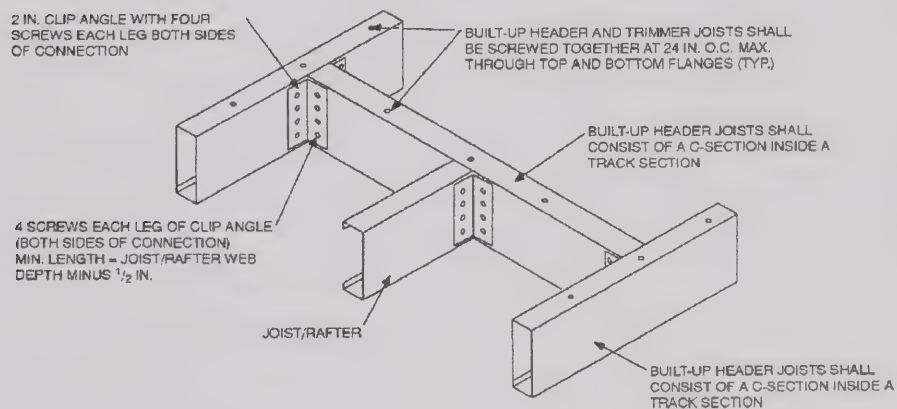


780 CMR FIGURE 5804.3.10(1)
ROOF OPENING



For SI: 1 foot = 304.8 mm.

780 CMR FIGURE 5804.3.10(2)
HEADER TO TRIMMER CONNECTION



For SI: 1 inch = 25.4 mm.

780 CMR 5805 CEILING FINISHES

5805.1 Ceiling installation. Ceilings shall be installed in accordance with the requirements for interior wall finishes as provided in 780 CMR 5702.

780 CMR 5806 ROOF VENTILATION

5806.1 Ventilation Required. Enclosed attics and enclosed rafter spaces formed where ceilings are applied directly to the underside of roof rafters shall have cross ventilation for each separate space by ventilating openings protected against the entrance of rain or snow. Ventilating openings shall be provided with corrosion-resistant wire mesh, with 1/8 inch (3.2 mm) minimum to 1/4 inch (6.4 mm) maximum openings.

Exceptions:

- 1. Roof assemblies where an expanding spray foam insulation material, providing at least 40% of the total R-value of the required insulation, is in direct contact with the underside of the roof deck and adjacent framing members. If the permeability of the foam material is less than two perm-inch, no vapor barrier is necessary.*
- 2. Roof assemblies where a board foam plastic insulation material, providing at least 40% of the total R-value of the required insulation, is placed on top of the roof deck. If the permeability of the foam material is less than two perm-inch, no vapor barrier is necessary.*

When either of the above exceptions is taken, the following conditions must also be satisfied:

- 1. The roof assembly, including the wall-to-eave-to-roof-deck connection must be made air tight, per 780 CMR J4.3.3 or 780 CMR I304.3, as possible.*
- 2. Thermal barrier requirements, if any, shall be per 780 CMR 2603.4, as applicable.*
- 3. The roof assembly must meet the fire-resistance-rating requirements of 780 CMR, when and as applicable.*
- 4. Roofing material must be listed/warranted by its manufacturer for use in an unvented roof system.*

5806.2 Minimum Area. The total net free ventilating area shall not be less than one to 150 of the area of the space ventilated except that the total

area is permitted to be reduced to one to 300, provided at least 50% and not more than 80% of the required ventilating area is provided by ventilators located in the upper portion of the space to be ventilated at least three feet (914 mm) above eave or cornice vents with the balance of the required ventilation provided by eave or cornice vents. As an alternative, the net free cross-ventilation area may be reduced to one to 300 when a vapor barrier having a transmission rate not exceeding one perm (57.4 mg/s · m² · Pa) is installed on the warm side of the ceiling.

5806.3 Vent Clearance. Where eave or cornice vents are installed, insulation shall not block the free flow of air. A minimum of a one-inch (25.4 mm) space shall be provided between the insulation and the roof sheathing at the location of the vent.

780 CMR 5807 ATTIC ACCESS

5807.1 Attic Access. An attic access opening shall be provided to attic areas that exceed 30 square feet (2.8 m²) and have a vertical height of 30 inches (762 mm) or greater.

The rough-framed opening shall not be less than 22 inches by 30 inches (559 mm by 762 mm) and shall be located in a hallway or other readily accessible location. A 30-inch (762 mm) minimum unobstructed headroom in the attic space shall be provided at some point above the access opening. See 780 CMR 6305.1.3 for access requirements where mechanical equipment is located in attics.

All attic access doors, trap doors, etc., separating conditioned from unconditioned space shall be fitted with suitable gaskets, weather strips, etc., and fit and close tightly to ensure minimal air leakage between conditioned and unconditioned space (also see 780 CMR 61.00).

780 CMR 5808 INSULATION CLEARANCE

5808.1 Combustible Insulation. Combustible insulation shall be separated a minimum of three inches (76 mm) from recessed lighting fixtures, fan motors and other heat-producing devices.

Exception: When heat-producing devices are listed for lesser clearances, combustible insulation complying with the listing requirements shall be separated in accordance with the conditions stipulated in the listing.

Recessed lighting fixtures installed in the building thermal envelope shall meet the requirements of 780 CMR 61.00.

ROOF ASSEMBLIES

780 CMR 5901 GENERAL

5901.1 Scope. The provisions of 780 CMR 59.00 shall govern the design, materials, construction and quality of roof assemblies *in one- and two-family detached dwellings and accessory buildings*.

780 CMR 5902 ROOF CLASSIFICATION

5902.1 Roofing Covering Materials. Roofs shall be covered with materials as set forth in 780 CMR 5904 and 5905 *and shall be a minimum of a Class C in accordance with UL 790 or ASTM E 108*. Roof assemblies with coverings of brick, masonry, slate, clay or concrete roof tile, exposed concrete roof deck, ferrous or copper shingles or sheets, and metal sheets and shingles, shall be considered Class A roof coverings.

5902.2 Fire-retardant-treated Shingles and Shakes. Fire-retardant-treated wood shakes and shingles shall be treated by impregnation with chemicals by the full-cell vacuum-pressure process, in accordance with AWPAC1. Each bundle shall be marked to identify the manufactured unit and the manufacturer, and shall also be labeled to identify the classification of the material in accordance with the testing required in 780 CMR 5902.1, the treating company and the quality control agency.

780 CMR 5903 WEATHER PROTECTION

5903.1 General. Roof decks shall be covered with approved roof coverings secured to the building or structure in accordance with the provisions of 780 CMR 59.00. Roof assemblies shall be designed and installed in accordance with this code and the approved manufacturer's installation instructions such that the roof assembly shall serve to protect the building or structure.

5903.2 Flashing. Flashings shall be installed in such a manner so as to prevent moisture entering the wall and roof through joints in copings, through moisture permeable materials, and at intersections with parapet walls and other penetrations through the roof plane.

5903.2.1 Locations. Flashings shall be installed at wall and roof intersections; wherever there is a change in roof slope or direction; and around roof openings. Where flashing is of metal, the metal shall be corrosion resistant with a thickness of not less than 0.019 inch (No. 26 galvanized sheet).

5903.3 Coping. Parapet walls shall be properly coped with noncombustible, weatherproof materials of a width no less than the thickness of the parapet wall.

5903.4 Roof Drainage. Unless roofs are sloped to drain over roof edges, roof drains shall be installed at each low point of the roof. Where required for roof drainage, scuppers shall be placed level with the roof surface in a wall or parapet. The scupper shall be located as determined by the roof slope and contributing roof area.

5903.4.1 Overflow Drains and Scuppers.

Where roof drains are required, overflow drains having the same size as the roof drains shall be installed with the inlet flow line located two inches (51 mm) above the low point of the roof, or overflow scuppers having three times the size of the roof drains and having a minimum opening height of four inches (102 mm) shall be installed in the adjacent parapet walls with the inlet flow located two inches (51 mm) above the low point of the roof served. The installation and sizing of overflow drains, leaders and conductors shall comply with the *Massachusetts State Plumbing Code (248 CMR)*.

Overflow drains shall discharge to an approved location and shall not be connected to roof drain lines.

780 CMR 5904 MATERIALS

5904.1 Scope. The requirements set forth in 780 CMR 5904 shall apply to the application of roof covering materials specified herein. Roof assemblies shall be applied in accordance with 780 CMR 59.00 and the manufacturer's installation instructions. Installation of roof assemblies shall comply with the applicable provisions of 780 CMR 5905.

5904.2 Compatibility of materials. Roof assemblies shall be of materials that are compatible with each other and with the building or structure to which the materials are applied.

5904.3 Material Specifications and Physical Characteristics. Roof covering materials shall conform to the applicable standards listed in 780 CMR 59.00. In the absence of applicable standards or where materials are of questionable suitability, testing by an approved testing agency shall be required by the building official to determine the character, quality and limitations of application of the materials.

5904.4 Product Identification. Roof covering materials shall be delivered in packages bearing the manufacturer's identifying marks and approved testing agency labels when required. Bulk shipments of materials shall be accompanied with the same information issued in the form of a certificate or on

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a bill of lading by the manufacturer.

780 CMR 5905 REQUIREMENTS FOR ROOF COVERINGS

5905.1 Roof covering Application. Roof coverings shall be applied in accordance with the applicable provisions of 780 CMR 5905 and the manufacturer's installation instructions. *Where there is a discrepancy between the requirements of 780 CMR 59.00 and the manufacturer's printed instructions or code evaluation report, the manufacturer's printed instructions shall govern.*

5905.2 Asphalt Shingles. The installation of asphalt shingles shall comply with the provisions of 780 CMR 5905.2.

5905.2.1 Sheathing Requirements. Asphalt shingles shall be fastened to solidly sheathed decks.

5905.2.2 Slope. Asphalt shingles shall only be used on roof slopes of two units vertical in 12 units horizontal (2:12) or greater. For roof slopes from two units vertical in 12 units horizontal (2:12) up to four units vertical in 12 units horizontal (4:12), double underlayment application is required in accordance with 780 CMR 5905.2.7.

5905.2.3 Underlayment. Unless otherwise noted, required underlayment shall conform with ASTM D 226, Type I, or ASTM D 4869, Type I. Self-adhering polymer modified bitumen sheet shall comply with ASTM D 1970.

5905.2.4 Asphalt Shingles. Asphalt shingles shall have self-seal strips or be interlocking, and comply with ASTM D 225 or D 3462.

5905.2.5 Fasteners. Fasteners for asphalt shingles shall be galvanized steel, stainless steel, aluminum or copper roofing nails, minimum 12 gage [0.105 inch (2.67 mm)] shank with a minimum $\frac{3}{8}$ -inch (9.5 mm) diameter head, ASTM F 1667, of a length to penetrate through the roofing materials and a minimum of $\frac{3}{4}$ inch (19.1 mm) into the roof sheathing. Where the roof sheathing is less than $\frac{3}{4}$ inch (19.1 mm) thick, the fasteners shall penetrate through the sheathing. Fasteners shall comply with ASTM F 1667.

5905.2.6 Attachment. Asphalt shingles shall have the minimum number of fasteners required by the manufacturer. For normal application, asphalt shingles shall be secured to the roof with not less than four fasteners per strip shingle or two fasteners per individual shingle. Where the roof slope exceeds 20 units vertical in 12 units horizontal (20:12), special methods of fastening are required. For roofs located where the basic wind speed per 780 CMR Figure 5301.2(4) is 110mph (177 km/h) or greater, special methods of fastening are required. Special fastening methods shall be tested in accordance with ASTM D 3161,

modified to use a wind speed of 110 mph (177 km/h).

Shingles classified using ASTM D 3161 are acceptable for use in wind zones less than 110 mph. Shingles classified using ASTM D 3161 modified to use a wind speed of 110 mph are acceptable for use in all cases where special fastening is required.

5905.2.7 Underlayment Application. *All roofs shall comply with the ice protection section of this code and also the following requirements.* For roof slopes from two units vertical in 12 units horizontal (17% slope), up to four units vertical in 12 units horizontal (33% slope), underlayment shall be two layers applied in the following manner. Apply a 19-inch (483 mm) strip of underlayment felt parallel with and starting at the eaves, fastened sufficiently to hold in place. Starting at the eave, apply 36-inch-wide (914 mm) sheets of underlayment, overlapping successive sheets 19 inches (483 mm), and fastened sufficiently to hold in place. For roof slopes of four units vertical in 12 units horizontal (33% slope) or greater, underlayment shall be one layer applied in the following manner. Underlayment shall be applied shingle fashion, parallel to and starting from the eave and lapped two inches (51 mm), fastened sufficiently to hold in place. End laps shall be offset by six feet (1829 mm).

5905.2.7.1 Ice Protection. An ice barrier that consists of a least two layers of underlayment cemented together or of a self-adhering polymer modified bitumen sheet, shall be used in lieu of normal underlayment and extend from the eave's edge to a point at least 24 inches (610 mm) inside the exterior wall line of the building.

Exception: Detached accessory structures that contain no conditioned floor area.

5905.2.7.2 Underlayment and High Wind. Underlayment applied in areas subject to high winds [greater than 110 mph (177km/h) per 780 CMR Figure 5301.2(4)] shall be applied with corrosion-resistant fasteners in accordance with manufacturer's installation instructions. Fasteners are to be applied along the overlap not farther apart than 36 inches (914 mm) on center.

5905.2.8 Flashing. Flashing for asphalt shingles shall comply with 780 CMR 5905.2.8.

5905.2.8.1 Base and Cap Flashing. Base and cap flashing shall be installed in accordance with manufacturer's installation instructions. Base flashing shall be of either corrosion-resistant metal of minimum nominal 0.019-inch (0.483 mm) thickness or mineral surface roll roofing weighing a minimum of 77 pounds per 100 square feet (3.76 kg/m²). Cap flashing shall be corrosion-resistant metal of

minimum nominal 0.019-inch (0.483 mm) thickness.

5905.2.8.2 Valleys. Valley linings shall be installed in accordance with manufacturer's installation instructions before applying shingles. Valley linings of the following types shall be permitted:

1. For open valley (valley lining exposed) lined with metal, the valley lining shall be at least 24 inches (610 mm) wide and of any of the corrosion-resistant metals in 780 CMR Table 5905.2.8.2.
2. For open valleys, valley lining of two plies of mineral surface roll roofing, complying with ASTM D 249, shall be permitted. The bottom layer shall be 18 inches (457 mm) and the top layer a minimum of 36 inches (914 mm) wide.
3. For closed valleys (valley covered with shingles), valley lining of one ply of smooth roll roofing complying with ASTM D 224 Type II or Type III and at least 36 inches (914 mm) wide or valley lining as described in 780 CMR 5905.2.8.2 Items 1 and 2 shall be permitted. Specialty underlayment complying with ASTM D 1970 may be used in lieu of the lining material.

**780 CMR TABLE 5905.2.8.2
VALLEY LINING MATERIAL**

MATERIAL	MINIMUM THICKNESS (inches)	GAGE	WEIGHT (pounds)
Cold-rolled copper	0.0216 nominal	—	ASTM B370, 16 oz. per square foot
Lead-coated copper	0.0216 nominal	—	ASTM B101, 16 oz. per square foot
High-yield copper	0.0162 nominal	—	ASTM B370, 12 oz. per square foot
Lead-coated high-yield copper	0.0162 nominal	—	ASTM B101, 12 oz. per square foot
Aluminum	0.024	—	—
Stainless steel	—	28	—
Galvanized steel	0.0179	26 (zinc coated G90)	—
Zinc alloy	0.027	—	—
Lead	—	—	2½
Painted terne	—	—	20

For SI: 1 inch = 25.4 mm, 1 pound = 0.454 kg.

5905.2.8.3 Crickets and Saddles. A cricket or saddle shall be installed on the ridge side of any chimney greater than 30 inches (762 mm) wide. Cricket or saddle coverings shall be

sheet metal or of the same material as the roof covering.

5905.2.8.4 Sidewall Flashing. Flashing against a vertical sidewall shall be by the step-flashing method.

5905.2.8.5 Other Flashing. Flashing against a vertical front wall, as well as soil stack, vent pipe and chimney flashing, shall be applied according to asphalt shingle manufacturer's printed instructions.

5905.3 Clay and Concrete Tile. The installation of clay and concrete shall comply with the provisions of 780 CMR 5905.3. Clay roof tile shall comply with ASTM C1 167.

5905.3.1 Deck Requirements. Concrete and clay tile shall be installed only over solid sheathing or spaced structural sheathing boards.

5905.3.2 Deck slope. Clay and concrete roof tile shall be installed on roof slopes of two and one-half units vertical in 12 units horizontal (2½:12) or greater. For roof slopes from two and one-half units vertical in 12 units horizontal (2½:12) to four units vertical in 12 units horizontal (4:12), double underlayment application is required in accordance with 780 CMR 5905.3.3.

5905.3.3 Underlayment. Unless otherwise noted, required underlayment shall conform with ASTM D 226, Type II; ASTM D 2626, Type I; or ASTM D 249 mineral surfaced roll roofing.

5905.3.3.1 Low Slope Roofs. For roof slopes from two and one-half units vertical in 12 units horizontal (2½:12), up to four units vertical in 12 units horizontal (4:12), underlayment shall be a minimum of two layers underlayment applies as follows:

1. Starting at the eave, a 19-inch (483 mm) strip of underlayment shall be applied parallel with the eave and fastened sufficiently in place.
2. Starting at the eave, 36-inch-wide (914 mm) strips of underlayment felt shall be applied, overlapping successive sheets 19 inches (483 mm), and fastened sufficiently in place.

5905.3.3.2 High Slope Roofs. For roof slopes of four units vertical in 12 units horizontal (4:12) or greater, underlayment shall be a minimum of one layer of underlayment felt applied shingle fashion, parallel to and starting from the eaves and lapped two inches (51 mm), fastened sufficiently in place.

5905.3.3.3 Underlayment and High Wind. Underlayment applied in areas subject to high wind [greater than 110 miles per hour (177 km/h) per 780 CMR Figure 5301.2(4)] shall be applied with corrosion-resistant fasteners in accordance with manufacturer's installation

instructions. Fasteners are to be applied along the overlap not farther apart than 36 inches (914 mm) on center.

5905.3.4 Tile. Clay roof tile shall comply with ASTM C 1167.

5905.3.5 Concrete Tile. Concrete roof tile shall comply with ASTM C 1492.

5905.3.6 Fasteners. Nails shall be corrosion-resistant and not less than 11 gage, $\frac{5}{16}$ -inch (10.6mm) head, and of sufficient length to penetrate the deck a minimum of $\frac{3}{4}$ inch (19.1 mm) or through the thickness of the deck, whichever is less. Attaching wire for clay or concrete tile shall not be smaller than 0.083 inch (2.1 mm). Perimeter fastening areas include three tile courses but not less than 36 inches (914 mm) from either side of hips or ridges and edges of eaves and gable rakes.

5905.3.7 Application. Tile shall be applied in accordance with 780 CMR 59.00 and the manufacturer's installation instructions, based on the following:

1. Climatic conditions.
2. Roof slope.
3. Underlayment system.
4. Type of tile being installed.

Clay and concrete roof tiles shall be fastened in accordance with 780 CMR 5905.3.7 and the manufacturer's installation instructions. Perimeter tiles shall be fastened with a minimum of one fastener per tile. Tiles with installed weight less than nine pounds per square foot (0.43 kN/m²) require a minimum of one fastener per tile regardless of roof slope. Clay and concrete roof tile attachment shall be in accordance with the manufacturer's installation instructions where applied in areas where the wind speed exceeds 100 miles per hour (161 km/h) and on buildings where the roof is located more than 40 feet (12192 mm) above grade. In areas subject to snow, a minimum of two fasteners per tile is required. In all other areas, clay and concrete roof tiles shall be attached in accordance with 780 CMR Table 5905.3.7.

**780 CMR TABLE 5905.3.7
CLAY AND CONCRETE TILE ATTACHMENT**

SHEATHING	ROOF SLOPE	NUMBER OF FASTENERS
Solid without battens	All	One per tile
Spaced or solid with battens and slope <5:12	Fasteners not required	—
Spaced sheathing without battens	5:12 ≤ slope < 12:12	One per tile/ every other row
	12:12 ≤ slope <24:12	One per tile

5905.3.8 Flashing. At the juncture of roof vertical surfaces, flashing and counter flashing

shall be provided in accordance with 780 CMR 59.00 and the manufacturer's installation instructions and, where of metal, shall not be less than 0.019 inch (0.48 mm) (No. 26 galvanized sheet gage) corrosion-resistant metal. The valley flashing shall extend at least 11 inches (279 mm) from the centerline each way and have a splash diverter rib not less than one inch (25.4 mm) high at the flow line formed as part of the flashing. Sections of flashing shall have an end lap of not less than four inches (102mm). For roof slopes of three units vertical in 12 units horizontal (25% slope) and greater, valley flashing shall have a 36-inch-wide (914 mm) underlayment of one layer of Type I underlayment running the full length of the valley, in addition to other required underlayment. In areas where the average daily temperature in January is 25°F (-4°C) or less, metal valley flashing underlayment shall be solid cemented to the roofing underlayment for slopes or be of self-adhering polymer modified bitumen sheet.

5905.4 Metal Roof Shingles. The installation of metal roof shingles shall comply with the provisions of 780 CMR 5905.4.

5905.4.1 Deck Requirements. Metal roof shingles shall be applied to a solid or closely fitted deck, except where the roof covering is specifically designed to be applied to spaced sheathing.

5905.4.2 Deck Slope. Metal roof shingles shall not be installed on roof slopes below three units vertical in 12 units horizontal (25% slope).

5905.4.3 Underlayment. An ice barrier that consists of at least two layers of underlayment cemented together or of a self-adhering polymer modified bitumen sheet, shall be used in lieu of normal underlayment and extend from the eave's edge to a point at least 24 inches (610 mm) inside the exterior wall line of the building. Underlayment shall comply with ASTM D 226, Type I.

Exception: Detached accessory structures that contain no conditioned floor area.

5905.4.4 Material Standards. Metal roof shingle roof coverings of galvanized steel shall be 0.013 inch (0.378 mm) minimum thickness. Metal roof shingle roof coverings of aluminum shall be of 0.024 inch (0.610 mm) minimum thickness.

5905.4.5 Application. Metal roof shingles shall be secured to the roof in accordance with 780 CMR 59.00 and the approved manufacturer's installation instructions

5905.4.6 Flashing. Roof valley flashing shall be provided of corrosion-resistant metal of the same material as the roof covering or shall comply with the standards in 780 CMR Table 5905.10.3. The

valley flashing shall extend at least eight inches (203 mm) from the center line each way and shall have a splash diverter rib not less than $\frac{3}{4}$ inch (19.1 mm) high at the flow line formed as part of the flashing. Sections of flashing shall have an end lap of not less than four inches (102 mm). The metal valley flashing shall have a 36-inch-wide (914 mm) underlayment directly under it consisting of one layer of underlayment running the full length of the valley, in addition to underlayment required for metal roof shingles. In areas where the average daily temperature in January is 25°F (-4°C) or less, the metal valley flashing underlayment shall be solid cemented to the roofing underlayment for roof slopes under seven units vertical in 12 units horizontal (58.3% slope) or self-adhering polymer modified bitumen sheet.

5905.5 Mineral-surfaced Roll Roofing. The installation of mineral-surfaced rolling roofing shall comply with 780 CMR 5905.5.

5905.5.1 Deck Requirements. Mineral-surfaced roll roofing shall be fastened to solidly sheathed roofs.

5905.5.2 Deck slope. Mineral-surfaced roll roofing shall not be applied on roof slopes below one unit vertical in 12 units horizontal (8% slope).

5905.5.3 Underlayment. An ice barrier that consists of at least two layers of underlayment cemented together or of a self-adhering polymer modified bitumen sheet, shall extend from the eave's edge to a point at least 24 inches (610 mm) inside the exterior wall line of the building. Underlayment shall conform with ASTM D 226, Type I.

Exception: Detached accessory structures that contain no conditioned floor area.

5905.5.4 Material Standards. Mineral-surfaced roll roofing shall conform to ASTM D 224, D 249, D 371 or D 3909.

5905.5.5 Application. Mineral-surfaced roll roofing shall be installed in accordance with 780 CMR 59.00 and the manufacturer's installation instructions.

5905.6 Slate and Slate-type Shingles. The installation of slate and slate-type shingles shall comply with the provisions of 780 CMR 5905.6.

5905.6.1 Deck Requirements. Slate shingles shall be fastened to solidly sheathed roofs.

5905.6.2 Deck Slope. Slate shingles shall only be used on slopes of four units vertical in 12 units horizontal (33% slope) or greater.

5905.6.3 Underlayment. An ice barrier that consists of at least two layers of underlayment cemented together or of a self-adhering polymer modified bitumen sheet, shall extend from the eave's edge to a point at least 24 inches (610 mm)

inside the exterior wall line of the building. Underlayment shall conform with ASTM D 226, Type I.

Exception: Detached accessory structures that contain no conditioned floor area.

5905.6.4 Material Standards. Slate shingles shall comply with ASTM C 406.

5905.6.5 Application. Minimum headlap for slate shingles shall be in accordance with 780 CMR Table 5905.6.5. Slate shingles shall be secured to the roof with two fasteners per slate. Slate shingles shall be installed in accordance with 780 CMR 59.00 and the manufacturer's installation instructions.

**780 CMR TABLE 5905.6.5
SLATE SHINGLE HEADLAP**

SLOPE	HEADLAP (inches)
4:12 $\leq$ slope < 8:12	4
8:12 $\leq$ slope < 20:12	3
Slope $\leq$ 20:12	2

For SI: 1 inch = 25.4 mm.

5905.6.6 Flashing. Flashing and counterflashing shall be made with sheet metal. Valley flashing shall be a minimum of 15 inches (381 mm) wide. Valley and flashing metal shall be a minimum uncoated thickness of 0.0179-inch (0.455 mm) zinc coated G90. Chimneys, stucco or brick walls shall have a minimum of two plies of felt for a cap flashing consisting of a four-inch-wide (102 mm) strip of felt set in plastic cement and extending 1 inch (25.4 mm) above the first felt and a top coating of plastic cement. The felt shall extend over the base flashing two inches (51 mm).

5905.7 Wood Shingles. The installation of wood shingles shall comply with the provisions of 780 CMR 5905.7.

5905.7.1 Deck Requirements. Wood shingles shall be installed on solid or spaced sheathing. Where spaced sheathing is used, sheathing boards shall not be less than one-inch by four-inch (25.4 mm by 102 mm) nominal dimensions and shall be spaced on centers equal to the weather exposure to coincide with the placement of fasteners.

5905.7.1.1 Solid Sheathing Required. In areas where the average daily temperature in January is 25°F (-4°C) or less, solid sheathing is required on that portion of the roof requiring the application of an ice shield.

5905.7.2 Deck Slope. Wood shingles shall be installed on slopes of three units vertical in 12 units horizontal (25% slope) or greater.

5905.7.3 Underlayment. An ice barrier that consists of at least two layers of underlayment cemented together or of a self-adhering polymer modified bitumen sheet, shall extend from the eave's edge to a point at least 24 inches (610 mm) inside the exterior wall line of the building.

Underlayment shall conform with ASTM D 226, Type I.

Exception: Detached accessory structures that contain no conditioned floor area.

5905.7.4 Material Standards. Wood shingles shall be of naturally durable wood and comply with the requirements of Table 780 CMR 5905.7.4.

780 CMR TABLE 5905.7.4
WOOD SHINGLE MATERIAL
REQUIREMENTS

MATERIAL	MINIMUM GRADES	APPLICABLE GRADING RULES
Wood shingles of naturally durable wood	1, 2 or 3	Cedar Shake and Shingle Bureau

5905.7.5 Application. Wood shingles shall be installed according to 780 CMR 59.00 and the manufacturer's installation instructions. Wood shingles shall be laid with a side lap not less than 1½ inches (38 mm) between joints in courses, and no two joints in any three adjacent courses shall be in direct alignment. Spacing between shingles shall not be less than ¼ inch to ⅜ inch (6.4 mm to 9.5 mm). Weather exposure for wood shingles shall not exceed those set in 780 CMR Table 5905.7.5. Fasteners for wood shingles shall be corrosion-resistant with a minimum penetration of ½ inch (12.7 mm) into the sheathing. For sheathing less than ½ inch (12.7 mm) in thickness, the fasteners shall extend through the sheathing. Wood shingles shall be attached to the roof with two fasteners per shingle, positioned no more than ¾ inch (19.1 mm) from each edge and no more than one inch (25.4 mm) above the exposure line.

780 CMR TABLE 5905.7.5
WOOD SHINGLE WEATHER EXPOSURE
AND ROOF SLOPE

ROOFING MATERIAL	LENGTH (inches)	GRADE	EXPOSURE (inches)	
			3:12 pitch to <4:12	4:12 pitch or steeper
Shingles of naturally durable wood	16	No. 1	3¾	5
		No. 2	3½	4
		No. 3	3	3½
	18	No. 1	4¼	5½
		No. 2	4	4½
		No. 3	3½	4
	24	No. 1	5¾	7½
		No. 2	5½	6½
		No. 3	5	5½

For SI: 1 inch = 25.4 mm.

5905.7.6 Valley Flashing. Roof flashing shall be not less than No. 26 gage [0.019 inches (0.48 mm)] corrosion-resistant sheet metal and shall extend ten inches (254 mm) from the centerline each way for roofs having slopes less than 12 units vertical in 12 units horizontal (100% slope), and seven inches (178 mm) from the centerline each way for slopes of 12 units vertical in 12 units horizontal and greater. Sections of flashing shall have an end lap of not less than four inches (102 mm).

5905.7.7 Label Required. Each bundle of shingles shall be identified by a label of an approved grading or inspection bureau or agency.

5905.8 Wood Shakes. The installation of wood shakes shall comply with the provisions of 780 CMR 5905.8.

5905.8.1 Deck Requirements. Wood shakes shall only be used on solid or spaced sheathing. Where spaced sheathing is used, sheathing boards shall not be less than one-inch by four-inch (25.4 mm by 102 mm) nominal dimensions and shall be spaced on centers equal to the weather exposure to coincide with the placement of fasteners. Where one-inch by four-inch (25.4 mm by 102 mm) spaced sheathing is installed at ten inches (254 mm) on center, additional one-inch by four-inch (25.4 mm by 102 mm) boards shall be installed between the sheathing boards.

5905.8.1.1 Solid sheathing Required. In areas where the average daily temperature in January is 25°F (-4°C) or less, solid sheathing is required on that portion of the roof requiring an ice barrier.

5905.8.2 Deck Slope. Wood shakes shall only be used on slopes of three units vertical in 12 units horizontal (25% slope) or greater.

5905.8.3 Underlayment. An ice barrier that consists of at least two layers of underlayment cemented together or a self-adhering polymer modified bitumen sheet, shall extend from the edge of the eave to a point at least 24 inches (610 mm) inside the exterior wall line of the building. Underlayment shall conform with ASTM D 226, Type I.

Exception: Detached accessory structures that contain no conditioned floor area.

5905.8.4 Interlayment. Interlayment shall comply with ASTM D 226, Type I.

5905.8.5 Material Standards. Wood shakes shall comply with the requirements of 780 CMR Table 5905.8.5.

5905.8.6 Application. Wood shakes shall be installed according to 780 CMR 59.00 and the manufacturer's installation instructions. Wood shakes shall be laid with a side lap not less than 1½ inches (38mm) between joints in adjacent

courses. Spacing between shakes in the same course shall be $\frac{1}{8}$ inch to $\frac{5}{8}$ inch (3.2 mm to 15.9 mm) for shakes and taper sawn shakes of naturally durable wood and shall be $\frac{1}{4}$ inch to $\frac{3}{8}$ inch (6.4 mm to 9.5 mm) for preservative taper sawn shakes. Weather exposure for wood shakes shall not exceed those set forth in 780 CMR Table 5905.8.6. Fasteners for wood shakes shall be corrosion-resistant, with a minimum penetration of $\frac{1}{2}$ inch (12.7 mm) into the sheathing. For sheathing less than $\frac{1}{2}$ inch (12.7 mm) in thickness, the fasteners shall extend through the sheathing. Wood shakes shall be attached to the roof with two fasteners per shake, positioned no more than one inch (25.4 mm) from each edge and no more than two inches (51 mm) above the exposure line.

5905.8.7 Shake Placement. The starter course at the eaves shall be doubled and the bottom layer shall be either 15-inch (381 mm), 18-inch (457 mm) or 24-inch (610 mm) wood shakes or wood

shingles. 15-inch (381 mm) or 18-inch (457 mm) wood shakes may be used for the final course at the ridge. Shakes shall be interlaid with 18-inch-wide (457 mm) strips of not less than No. 30 felt shingled between each course in such a manner that no felt is exposed to the weather by positioning the lower edge of each felt strip above the butt end of the shake it covers a distance equal to twice the weather exposure.

5905.8.8 Valley Flashing. Roof valley flashing shall not be less than No. 26 gage [0.019 inches (0.48 mm)] corrosion-resistant sheet metal and shall extend at least 11 inches (279 mm) from the centerline each way. Sections of flashing shall have an end lap of not less than 4 inches (102 mm).

5905.8.9 Label required. Each bundle of shakes shall be identified by a label of an approved grading or inspection bureau or agency.

780 CMR TABLE 5905.8.5
WOOD SHAKE MATERIAL REQUIREMENTS

MATERIAL	MINIMUM GRADES	APPLICABLE GRADING RULES
Wood shakes of naturally durable wood	1	Cedar Shake and Shingle Bureau
Taper sawn shakes of naturally durable wood	1 or 2	Cedar Shake and Shingle Bureau
Preservative-treated shakes and shingles of naturally durable wood	1	Cedar Shake and Shingle Bureau
Fire-retardant-treated shakes and shingles of naturally durable wood	1	Cedar Shake and Shingle Bureau
Preservative-treated taper sawn shakes of southern yellow pine treated in accordance with AWP Standard C2	1 or 2	Forest Products Laboratory of the Texas Forest Services

780 CMR TABLE 5905.8.6
WOOD SHAKE WEATHER EXPOSURE AND ROOF SLOPE

ROOFING MATERIAL	LENGTH (inches)	GRADE	EXPOSURE (inches)
			4:12 pitch or steeper
Shakes of naturally durable wood	18	No. 1	7½
	24	No. 1	10 ^a
Preservative-treated taper sawn shakes of Southern Yellow Pine	18	No. 1	7½
	24	No. 1	10
	18	No. 2	5½
	24	No. 2	7½
Taper sawn shakes of naturally durable wood	18	No. 1	7½
	24	No. 1	10
	18	No. 2	5½
	24	No. 2	7½

For SI: 1 inch = 25.4 mm.

a. For 24-inch by $\frac{3}{8}$ -inch handsplit shakes, the maximum exposure is 7½ inches.

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5905.9 Built-up Roofs. The installation of built-up roofs shall comply with the provisions of 780 CMR 5905.9.

5905.9.1 Slope. Built-up roofs shall have a design slope of a minimum of $\frac{1}{4}$ unit vertical in 12 units horizontal (2% slope) for drainage, except for coal-tar built-up roofs, which shall have a design slope of a minimum $\frac{1}{8}$ unit vertical in 12 units horizontal (1% slope).

5905.9.2 Material Standards. Built-up roof covering materials shall comply with the standards in 780 CMR Table 5905.9.2.

5905.9.3 Application. Built-up roofs shall be installed according to 780 CMR 59.00 and the manufacturer's installation instructions.

5905.10 Metal Roof Panels. The installation of

metal roof panels shall comply with the provisions of 780 CMR 5905.10.

5905.10.1 Deck Requirements. Metal roof panel roof coverings shall be applied to a solid or spaced sheathing, except where the roof covering is specifically designed to be applied to spaced supports.

5905.10.2 Slope. The minimum slope for lapped, nonsoldered seam metal roofs without applied lap sealant shall be three units vertical in 12 units horizontal (25% slope). The minimum slope for lapped, nonsoldered seam metal roofs with applied lap sealant shall be $\frac{1}{2}$ vertical unit in 12 units horizontal (4% slope). The minimum slope for standing seam roof systems shall be $\frac{1}{4}$ unit vertical in 12 units horizontal (2% slope).

**780 CMR TABLE 5905.9.2
BUILT-UP ROOFING MATERIAL STANDARDS**

MATERIAL STANDARD	STANDARD
Acrylic coatings used in roofing	ASTM D 6083
Aggregate surfacing	ASTM D 1863
Asphalt adhesive used in roofing	ASTM D 3747
Asphalt cements used in roofing	ASTM D 3019; D 2822; D 4586
Asphalt-coated glass fiber base sheet	ASTM D 4601
Asphalt coatings used in roofing	ASTM D 1227; D 2823; D 2824; D 4479
Asphalt glass felt	ASTM D 2178
Asphalt primer used in roofing	ASTM D 41
Asphalt-saturated and asphalt-coated organic felt base sheet	ASTM D 2626
Asphalt-saturated organic felt (perforated)	ASTM D 226
Asphalt used in roofing	ASTM D 312
Coal tar cements used in roofing	ASTM D 4022; D 5643
Coal-tar saturated organic felt	ASTM D 227
Coal-tar primer used in roofing, dampproofing and waterproofing	ASTM D 43
Coal-tar used in roofing	ASTM D 450, Types I or II
Glass mat, coal tar	ASTM D 4990
Glass mat, venting type	ASTM D 4897
Mineral-surfaced inorganic cap sheet	ASTM D 3909
Thermoplastic fabrics used in roofing	ASTM D 5665; D 5726

780 CMR TABLE 5905.10.3

METAL ROOF COVERINGS STANDARDS AND INSTALLATION

ROOF COVERING TYPE	STANDARD APPLICATION RATE/THICKNESS
Aluminum	ASTM B 209, 0.024 inch minimum thickness for rollformed panels and 0.019 inch minimum thickness for pressformed shingles.
Aluminum zinc alloy coated steel	ASTM A 792 AZ 50
Copper	ASTM B 370, 16 oz. per sq. ft. for metal sheet roof covering systems; 12 oz. per sq. ft. for preformed metal shingle systems; CDA 4115
Galvanized steel	ASTM A 653 G-90 zinc coated, 0.013 inch thick minimum
Hard lead	2 lbs. per sq. ft.
Lead-coated copper	ASTM B 101
Prepainted steel	ASTM A 755
Soft lead	3 lbs. per sq. ft.
Terne (tin) and terne coated stainless	Terne coating of 40 lb. per double base box, field painted where applicable in accordance with manufacturer's installation instructions.

For SI: 1 ounce per square foot = 0.0026 kg/m², 1 pound per square foot = 4.882 kg/m², 1 inch = 25.4 mm, 1 pound = 0.454 kg.

5905.10.3 Material Standards. Metal-sheet roof covering systems that incorporate supporting structural members shall be designed in accordance with the *International Building Code*. Metal-sheet roof coverings installed over structural decking shall comply with 780 CMR Table 5905.10.3.

5905.10.4 Attachment. Metal roofing shall be installed in accordance with 780 CMR 59.00 and the manufacturer's installation instructions. Metal roofing fastened directly to steel framing shall be attached by approved fasteners. The following fasteners shall be used:

1. Galvanized fasteners shall be used for galvanized roofs.
2. Three hundred series stainless steel fasteners shall be used for copper roofs.
3. Stainless steel fasteners are acceptable for metal roofs.

5905.11 Modified Bitumen Roofing. The installation of modified bitumen roofing shall comply with the provisions of 780 CMR 5905.11.

5905.11.1 Slope. Modified bitumen membrane roofs shall have a design slope of a minimum of ¼ unit vertical in 12 units horizontal (2% slope) for drainage.

5905.11.2 Material Standards. Modified bitumen roof coverings shall comply with the standards in Table 780 5905.11.2.

780 CMR TABLE R905.11.2
MODIFIED BITUMEN ROOFING
MATERIAL STANDARDS

MATERIAL	STANDARD
Acrylic coating	ASTM D 6083
Asphalt adhesive	ASTM D 3747
Asphalt cement	ASTM D 3019
Asphalt coating	ASTM D 1227; D 2824
Asphalt primer	ASTM D 41
Modified bitumen roof membrane	ASTM D 6162; D 6163; D 6164; D 6222; D 6223; D 6298; CGSB 37-56M

5905.11.3 Application. Modified bitumen roofs shall be installed according to 780 CMR 59.00 and the manufacturer's installation instructions.

5905.12 Thermoset Single-ply Roofing. The installation of thermoset single-ply roofing shall comply with the provisions of 780 CMR 5905.12.

5905.12.1 Slope. Thermoset single-ply membrane roofs shall have a design slope of a minimum of ¼ unit vertical in 12 units horizontal (2% slope) for drainage.

5905.12.2 Materials Standards. Thermoset single-ply roof coverings shall comply with RMA RP-1, RP-2 or RP-3, or ASTM D 4637, ASTM D 5019 or CGSB 37-52M.

5905.12.3 Application. Thermoset single-ply roofs shall be installed according to 780 CMR 59.00 and the manufacturer's installation instructions.

5905.13 Thermoplastic Single-ply Roofing. The installation of thermoplastic single-ply roofing shall comply with the provisions of 780 CMR 5905.13.

5905.13.1 Slope. Thermoplastic single-ply membrane roofs shall have a design slope of a minimum of ¼ unit vertical in 12 units horizontal (2% slope).

5905.13.2 Material Standards. Thermoplastic single-ply roof coverings shall comply with

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ASTM D 4434 or CGSB 37-54M.

5905.13.3 Application. Thermoplastic single-ply roofs shall be installed according to 780 CMR 59.00 and the manufacturer's installation instructions.

5905.14 Sprayed Polyurethane Foam Roofing. The installation of sprayed polyurethane foam roofing shall comply with the provisions of 780 CMR 5905.14.

5905.14.1 Slope. Sprayed polyurethane foam roofs shall have a design slope of a minimum of $\frac{1}{4}$ unit vertical in 12 units horizontal (2% slope) for drainage.

5905.14.2 Material Standards. Spray-applied polyurethane-foam insulation shall comply with ASTM C 1029.

5905.14.3 Application. Foamed in place roof insulation shall be installed in accordance with 780 CMR 59.00 and the manufacturer's installation instructions. A liquid-applied protective coating that complies with 780 CMR 5905.15 shall be applied no less than two hours nor more than 72 hours following the application of the foam.

5905.14.4 Foam Plastics. Foam plastic materials and installation shall comply with 780 CMR 5314.

5905.15 Liquid-applied Coatings. The installation of liquid-applied coatings shall comply with the provisions of 780 CMR 5905.15.

5905.15.1 Slope. Liquid-applied roofs shall have a design slope of a minimum of one-fourth unit vertical in 12 units horizontal (2% slope).

5905.15.2 Material Standards. Liquid-applied roof coatings shall comply with ASTM C 836, C 957, D 1227, D 3468 or D 6083.

5905.15.3 Application. Liquid-applied roof coatings shall be installed according to 780 CMR 59.00 and the manufacturer's installation instructions.

780 CMR 5906 ROOF INSULATION

5906.1 General. The use of above deck thermal insulation shall be permitted provided such insulation is covered with an approved roof covering and passes FM 4450 or UL 1256.

Note: Compliance with applicable sections of 780 CMR 61.00 is also required.

780 CMR 5907 REROOFING

5907.1 General. Materials and methods of application used for recovering or replacing an existing roof covering shall comply with the requirements of 780 CMR 59.00.

Exception: Reroofing shall not be required to meet the minimum design slope requirement of $\frac{1}{4}$ unit vertical in 12 units horizontal (2% slope) in 780 CMR 5905 for roofs that provide positive roof drainage.

5907.2 Structural and Construction Loads. The structural roof components shall be capable of supporting the roof covering system and the material and equipment loads that will be encountered during installation of the roof covering system.

5907.3 Recovering versus replacement (also see 780 CMR 9304.4.3). New roof coverings shall not be installed without first removing existing roof coverings where any of the following conditions occur:

1. Where the existing roof or roof covering is water-soaked or has deteriorated to the point that the existing roof or roof covering is not adequate as a base for additional roofing.
2. Where the existing roof covering is wood shake, slate, clay, cement or asbestos-cement tile.
3. Where the existing roof has two or more applications of any type of roof covering.

Exceptions:

1. Complete and separate roofing systems, such as standing-seam metal roof systems, that are designed to transmit the roof loads directly to the building's structural system and that do not rely on existing roofs and roof coverings for support shall not require the removal of existing roof coverings.
2. Metal panel, metal shingle, and concrete and clay tile roof coverings shall be permitted to be installed over existing wood shake roofs when applied in accordance with 780 CMR 5907.4.

5907.4 Roof Recovering. Where the application of a new roof covering over wood shingle or shake roofs creates a combustible concealed space, the entire existing surface shall be covered with gypsum board, mineral fiber, glass fiber or other approved materials securely fastened in place.

5907.5 Reinstallation of Materials. Existing slate, clay or cement tile shall be permitted for reinstallation, except that damaged, cracked or broken slate or tile shall not be reinstalled. Existing vent flashing, metal edgings, drain outlets, collars and metal counterflashings shall not be reinstalled where rusted, damaged or deteriorated. Aggregate surfacing materials shall not be reinstalled.

5907.6 Flashings. Flashings shall be reconstructed in accordance with approved manufacturer's installation instructions. Metal flashing to which bituminous materials are to be adhered shall be primed prior to installation.

Note: Compliance with applicable sections of 780 CMR 61.00 is also required.

780 CMR 60.00

CHIMNEYS, FIREPLACES AND SOLID FUEL-BURNING APPLIANCES

780 CMR 6001 MASONRY CHIMNEYS

6001.1 General. Masonry chimneys shall be constructed, anchored, supported and reinforced as required in 780 CMR 60.00 and the applicable provisions of 780 CMR 53.00, 54.00 and 56.00. *Chimneys shall be structurally sound, durable, smoke tight and capable of conveying flue gases to the exterior safely.*

6001.1.1 Support. Masonry chimneys shall be supported on foundations of solid masonry or concrete at least 12 inches (305 mm) thick and at least six inches (152 mm) beyond each side of the exterior dimensions of the chimney. Footings shall be founded on natural, undisturbed earth below the frostline. In areas not subject to freezing, footings shall be located a minimum of 12 inches (305 mm) below finished grade.

6001.2 Corbeling. Masonry chimneys shall not be corbeled more than one-half of the chimney's wall thickness from a wall or foundation, nor shall a chimney be corbeled from a wall or foundation that is less than 12 inches (305 mm) in thickness unless it projects equally on each side of the wall, except that on the second story of a two-story dwelling, corbeling of chimneys on the exterior of the enclosing walls may equal the wall thickness. The projection of a single course shall not exceed one-half the unit height or one-third of the unit bed depth, whichever is less.

6001.3 Changes in Dimension. The chimney wall or chimney flue lining shall not change in size or shape within six inches (152 mm) above or below where the chimney passes through floor components, ceiling components or roof components.

6001.4 Offsets. Where a masonry chimney is constructed with a fireclay flue liner surrounded by one wythe of masonry, the maximum offset shall be such that the centerline of the flue above the offset does not extend beyond the center of the chimney wall below the offset. Where the chimney offset is supported by masonry below the offset in an approved manner, the maximum offset limitations shall not apply. Each individual corbeled masonry course of the offset shall not exceed the projection limitations specified in 780 CMR 6001.2.

6001.5 Additional Load. Chimneys shall not support loads other than their own weight unless they are designed and constructed to support the additional load. Masonry chimneys shall be permitted to be constructed as part of the masonry walls or reinforced concrete walls of the building.

6001.6 Termination. Chimneys shall extend at

least two feet (610 mm) higher than any portion of a building within 10 feet (3048 mm), but shall not be less than three feet (914 mm) above the highest point where the chimney passes through the roof.

6001.6.1 Spark Arrestors. Where a spark arrestor is installed on a masonry chimney, the spark arrestor shall meet all of the following requirements:

1. The net free area of the arrestor shall not be less than four times the net free area of the outlet of the chimney flue it serves.
2. The arrestor screen shall have heat and corrosion resistance equivalent to 19-gage galvanized steel or 24-gage stainless steel.
3. Openings shall not permit the passage of spheres having a diameter greater than ½ inch (12.7 mm) nor two block the passage of spheres having a diameter less than ⅝ inch (9.5 mm).
4. The spark arrestor shall be accessible for cleaning and the screen or chimney cap shall be removable to allow for cleaning of the chimney flue.

6001.7 Wall Thickness. Masonry chimney walls shall be constructed of solid masonry units or hollow masonry units grouted solid with not less than a four-inch (602 mm) nominal thickness.

6001.8 Flue Lining (Material). Masonry chimneys shall be lined. The lining material shall be appropriate for the type of appliance connected, according to the terms of the appliance listing and manufacturer's instructions.

6001.8.1 Residential-type Appliances (General). Flue lining systems shall comply with one of the following:

1. Clay flue lining complying with the requirements of ASTM C 315 or equivalent.
2. Listed chimney lining systems complying with UL 1777.
3. Factory-built chimneys or chimney units listed for installation within masonry chimneys.
4. Other approved materials that will resist corrosion, erosion, softening, or cracking from flue gases and condensate at temperatures up to 1,800°F (982°C).

6001.8.2 Flue Linings for Specific Appliances. Flue linings other than those covered in 780 CMR 6001.8.1, intended for use with specific types of appliances, shall comply with 780 CMR 6001.8.3 through 6001.8.6.

6001.8.3 Gas Appliances. Flue lining systems for gas appliances shall be in accordance with 248 CMR.

6001.8.4 Pellet Fuel-burning Appliances. Flue lining and vent systems for use in masonry chimneys with pellet fuel-burning appliances shall be limited to the following:

1. Flue lining systems complying with 780 CMR 6001.8.1.
2. Pellet vents listed for installation within masonry chimneys. (See 780 CMR 6001.8.6 for marking.)

6001.8.5 Oil-fired Appliances Approved for Use with Type L Vent. See 527 CMR 4.

6001.8.6 Notice of Usage. When a flue is relined with a material not complying with 780 CMR 6001.8.1, the chimney shall be plainly and permanently identified by a label attached to a wall, ceiling or other conspicuous location adjacent to where the connector enters the chimney. The label shall include the following message or equivalent language:

THIS CHIMNEY FLUE IS FOR USE ONLY WITH [TYPE OR CATEGORY OF APPLIANCE] APPLIANCES THAT BURN [TYPE OF FUEL]. DO NOT CONNECT OTHER TYPES OF APPLIANCES.

6001.9 Flue Lining (Installation). Flue liners shall be installed in accordance with ASTM C 1283 and extend from a point not less than eight inches (203 mm) below the lowest inlet or, in the case of fireplaces, from the top of the smoke chamber to a point above the enclosing walls. The lining shall be carried up vertically, with a maximum slope no greater than 30 degrees from the vertical.

Fireclay flue liners shall be laid in medium duty refractory mortar conforming to ASTM C 199 with tight mortar joints left smooth on the inside and installed to maintain an air space or insulation not to exceed the thickness of the flue liner separating the flue liners from the interior face of the chimney masonry walls. Flue lining shall be supported on all sides. Only enough mortar shall be placed to make the joint and hold the liners in position.

6001.9.1 Listed Materials. Listed materials used as flue linings shall be installed in accordance with the terms of their listings and manufacturer's instructions.

6001.9.2 Space around Lining. The space surrounding a chimney lining system or vent installed within a masonry chimney shall not be used to vent any other appliance.

Exception: This shall not prevent the installation of a separate flue lining in accordance with the manufacturer's installation instructions.

6001.10 Multiple Flues. When two or more flues are located in the same chimney, masonry wythes shall be built between adjacent flue linings. The masonry wythes shall be at least four inches (602 mm) thick and bonded into the walls of the chimney.

Exception: When venting only one appliance, two flues may adjoin each other in the same chimney with only the flue lining separation between them. The joints of the adjacent flue linings shall be staggered at least four inches (102 mm).

6001.11 Flue Area (Appliance). Chimney flues shall not be smaller in area than that of the area of the connector from the appliance [see 780 CMR Tables 6001.11(1) and 6001.11(2)]. The sizing of a chimney flue to which multiple appliance venting systems are connected shall be in accordance with 780 CMR 6805.3.

780 CMR TABLE 6001.11(1)
NET CROSS-SECTIONAL AREA OF
ROUND FLUE SIZES*

FLUE SIZE, INSIDE DIAMETER (inches)	CROSS-SECTIONAL AREA (square inches)
6	28
7	38
8	50
10	78
10¾	90
12	113
15	176
18	254

For SI: 1 inch = 25.4 mm, 1 square inch = 645.16 mm².
a. Flue sizes are based on ASTM C 315.

780 CMR TABLE 6001.11(2)
NET CROSS-SECTIONAL AREA OF
SQUARE AND RECTANGULAR FLUE SIZES*

FLUE SIZE, OUTSIDE DIMENSIONS (inches)	CROSS-SECTIONAL AREA (square inches)
4½ x 13	34
7½ x 7½	37
8½ x 8½	47
7½ x 11½	58
8½ x 13	74
7½ x 15½	82
11½ x 11½	91
8½ x 17½	101
13 x 13	122
11½ x 15½	124
13 x 17½	165
15½ x 15½	168
15½ x 19½	214
17½ x 17½	226
19½ x 19½	269
20 x 20	286

For SI: 1 inch = 25.4 mm, 1 square inch = 645.16 mm².
a. Flue sizes are based on ASTM C 315.

6001.12 Flue Area (Masonry Fireplace). Flue sizing for chimneys serving fireplaces shall be in accordance with 780 CMR 6001.12.1 or 780 CMR 6001.12.2.

6001.12.1 Option 1. Round chimney flues shall have a minimum net cross-sectional area of at least 1/12 of the fireplace opening. Square chimney

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flues shall have a minimum net cross-sectional area of $\frac{1}{10}$ of the fireplace opening. Rectangular chimney flues with an aspect ratio less than two to one shall have a minimum net cross-sectional area of $\frac{1}{10}$ of the fireplace opening. Rectangular chimney flues with an aspect ratio of two to one or more shall have a minimum net cross-sectional area of $\frac{1}{10}$ of the fireplace opening.

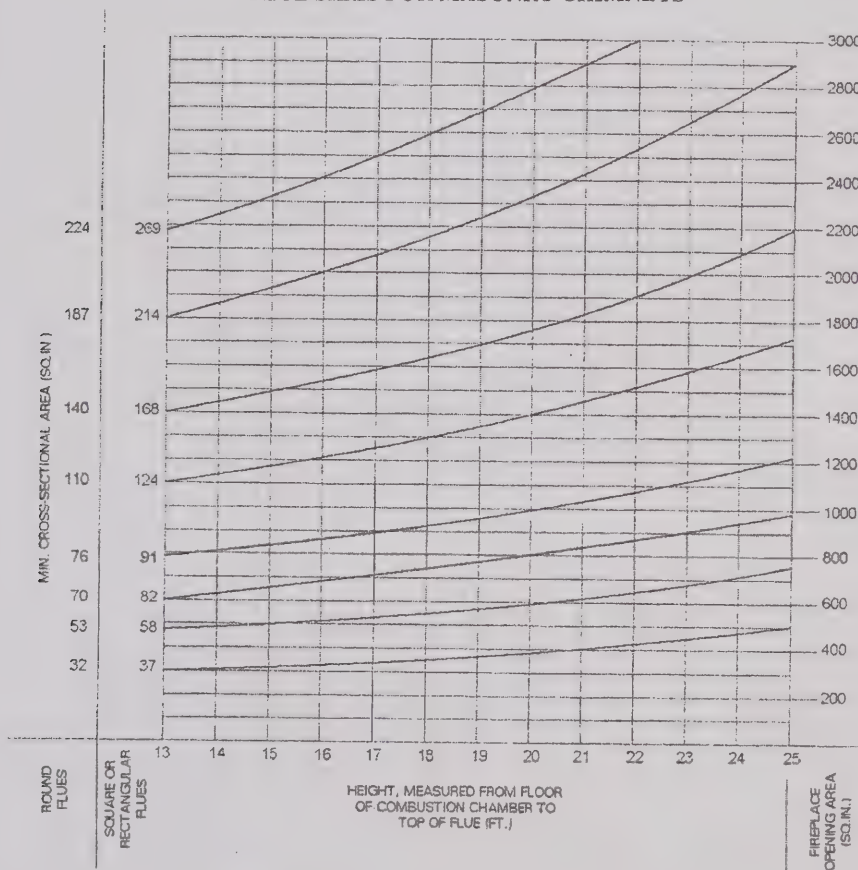
6001.12.2 Option 2. The minimum net cross-sectional area of the chimney flue shall be determined in accordance with 780 CMR Figure 6001.12.2. A flue size providing at least the equivalent net cross-sectional area shall be used. Cross-sectional areas of clay flue linings are provided in 780 CMR Tables 6001.11(1) and 6001.11(2) or as provided by the manufacturer or as measured in the field. The height of the chimney shall be measured from the firebox floor to the top of the chimney flue.

6001.13 Inlet. Inlets to masonry chimneys shall enter from the side. Inlets shall have a thimble of fireclay, rigid refractory material or metal that will prevent the connector from pulling out of the inlet or from extending beyond the wall of the liner.

6001.14 Masonry Chimney Cleanout Openings. Cleanout openings shall be provided within six inches (152 mm) of the base of each flue within every masonry chimney. The upper edge of the cleanout shall be located at least six inches (152 mm) below the lowest chimney inlet opening. The height of the opening shall be at least six inches (152 mm). The cleanout shall be provided with a noncombustible cover.

Exception: Chimney flues serving masonry fireplaces where cleaning is possible through the fireplace opening.

780 CMR FIGURE 6001.12.2
FLUE SIZES FOR MASONRY CHIMNEYS



For SI: 1 foot = 304.8 mm, 1 square inch = 645.16 mm².

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6001.15 Chimney Clearances. Any portion of a masonry chimney located in the interior of the building or within the exterior wall of the building shall have a minimum air space clearance to combustibles of two inches (51 mm). Chimneys located entirely outside the exterior walls of the building, including chimneys that pass through the soffit or cornice, shall have a minimum air space clearance of one inch (25.4 mm). The air space shall not be filled, except to provide fire blocking in accordance with 780 CMR 6001.16.

Exceptions:

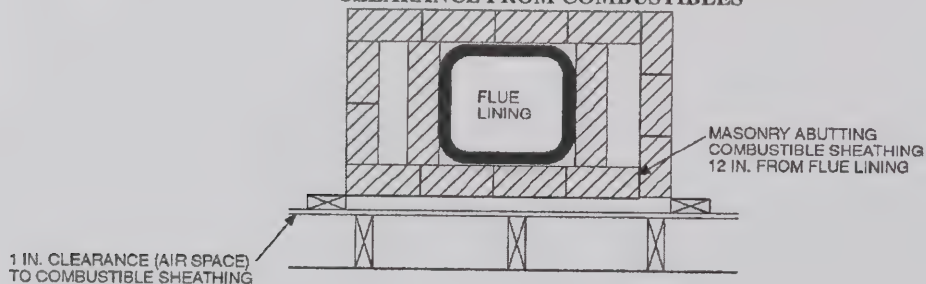
1. Masonry chimneys equipped with a chimney lining system listed and labeled for use in chimneys in contact with combustibles in accordance with UL 1777 and installed in accordance with the manufacturer's installation instructions are permitted to have combustible material in contact with their exterior surfaces.
2. When masonry chimneys are constructed as part of masonry or concrete walls, combustible materials shall not be in contact with the masonry or concrete wall less than 12 inches (306 mm) from the inside surface of the nearest flue lining.
3. Exposed combustible trim and the edges of sheathing materials, such as wood siding and

flooring, shall be permitted to abut the masonry chimney side walls, in accordance with Figure 6001.15 provided such combustible trim or sheathing is a minimum of 12 inches (306 mm) from the inside surface of the nearest flue lining. Combustible material and trim shall not overlap the corners of the chimney by more than one inch (25.4 mm).

6001.16 Chimney Fireblocking. All spaces between chimneys and floors and ceilings through which chimneys pass shall be fireblocked with noncombustible material securely fastened in place. The fireblocking of spaces between chimneys and wood joists, beams or headers shall be to a depth of one inch (25.4 mm) and shall only be placed on strips of metal or metal lath laid across the spaces between combustible material and the chimney.

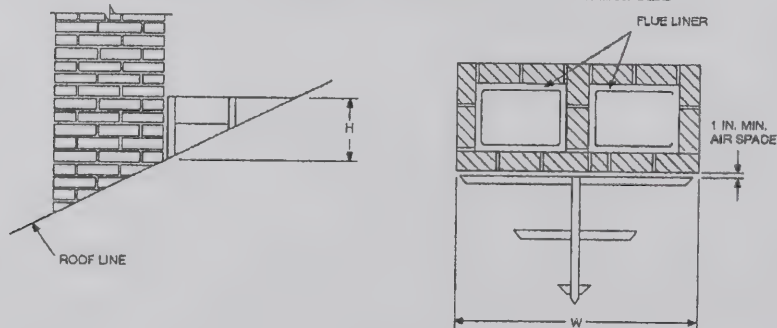
6001.17 Chimney Crickets. Chimneys shall be provided with crickets when the dimension parallel to the ridgeline is greater than 30 inches (762 mm) and does not intersect the ridgeline. The intersection of the cricket and the chimney shall be flashed and counterflashed in the same manner as normal roof-chimney intersections. Crickets shall be constructed in compliance with 780 CMR Figure 6001.17 and 780 CMR Table 6001.17.

780 CMR FIGURE 6001.15
CLEARANCE FROM COMBUSTIBLES



For SI: 1 inch = 25.4 mm.

780 CMR FIGURE 6001.17
CHIMNEY CRICKET CHIMNEYS AND FIREPLACES



For SI: 1 inch = 25.4 mm.

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780 CMR TABLE 6001.17
CRICKET DIMENSIONS

ROOF SLOPE	H
12 - 12	$\frac{1}{2}$ of W
8 - 12	$\frac{1}{3}$ of W
6 - 12	$\frac{1}{4}$ of W
4 - 12	$\frac{1}{6}$ of W
3 - 12	$\frac{1}{8}$ of W

780 CMR 6002 FACTORY-BUILT
CHIMNEYS

6002.1 Listing. Factory-built chimneys shall be listed and labeled and shall be installed and terminated in accordance with the manufacturer's installation instructions.

6002.2 Decorative Shrouds. Decorative shrouds shall not be installed at the termination of factory-built chimneys except where such shrouds are listed and labeled for use with the specific factory-built chimney system and installed in accordance with the manufacturer's installation instructions.

6002.3 Solid Fuel Appliances. Factory-built chimneys for use with solid fuel-burning appliances shall comply with the Type HT requirements of UL 103.

Exception: Chimneys for use with fireplace stoves listed only to UL 737 shall comply with the requirements of UL 103.

6002.4 Factory-built Fireplaces. Chimneys for use with factory-built fireplaces shall comply with the requirements of UL 127.

6002.5 Support. Where factory-built chimneys are supported by structural members, such as joists and rafters, such members shall be designed to support the additional load.

6002.6 Medium-heat Appliances. Factory-built chimneys for medium-heat appliances producing flue gases having a temperature above 1,000°F (538°C), measured at the entrance to the chimney shall comply with UL 959.

780 CMR 6003 MASONRY FIREPLACES

6003.1 General. Masonry fireplaces shall be constructed in accordance with 780 CMR 6003 and the applicable provisions of 780 CMR 53.00 and 54.00.

6003.2 Footings and Foundations. Footings for masonry fireplaces and their chimneys shall be constructed of concrete or solid masonry at least 12 inches (305 mm) thick and shall extend at least six inches (152 mm) beyond the face of the fireplace or foundation wall on all sides. Footings shall be founded on natural, undisturbed earth or engineered fill below frost depth. In areas not subjected to freezing, footings shall be at least 12 inches (305 mm) below finished grade.

6003.2.1 Ash Dump Cleanout. Cleanout openings located within foundation walls below fireboxes, when provided, shall be equipped with ferrous metal or masonry doors and frames constructed to remain tightly closed except when in use. Cleanouts shall be accessible and located so that ash removal will not create a hazard to combustible materials.

6003.3 Firebox Walls. Masonry fireboxes shall be constructed of solid masonry units, hollow masonry units grouted solid, stone or concrete. When a lining of firebrick at least two inches (51 mm) in thickness or other approved lining is provided, the minimum thickness of back and side walls shall each be eight inches (203 mm) of solid masonry, including the lining. The width of joints between firebricks shall not be greater than $\frac{1}{4}$ inch (6.4 mm). When no lining is provided, the total minimum thickness of back and side walls shall be ten inches (254 mm) of solid masonry. Firebrick shall conform to ASTM C 27 or C 1261 and shall be laid with medium duty refractory mortar conforming to ASTM C 199.

6003.3.1 Steel Fireplace Units. Steel fireplace units are permitted to be installed with solid masonry to form a masonry fireplace when installed either according to the requirements of their listing or according to the requirements of 780 CMR 6003. Steel fireplace units incorporating a steel firebox lining, shall be constructed with steel not less than $\frac{1}{4}$ inch (6.4mm) in thickness, and an air circulating chamber which is ducted to the interior of the building. The firebox lining shall be encased with solid masonry to provide a total thickness at the back and sides of not less than eight inches (203 mm), of which not less than four inches (102 mm) shall be of solid masonry or concrete. Circulating air ducts employed with steel fireplace units shall be constructed of metal or masonry.

6003.4 Firebox Dimensions. The firebox of a concrete or masonry fireplace shall have a minimum depth of 20 inches (508 mm). The throat shall not be less than eight inches (203 mm) above the fireplace opening. The throat opening shall not be less than four inches (102 mm) in depth. The cross-sectional area of the passageway above the firebox, including the throat, damper and smoke chamber, shall not be less than the cross-sectional area of the flue.

Exception: Rumford fireplaces shall be permitted provided that the depth of the fireplace is at least 12 inches (305 mm) and at least $\frac{1}{3}$ of the width of the fireplace opening, that the throat is at least 12 inches (305 mm) above the lintel and is at least $\frac{1}{20}$ the cross-sectional area of the fireplace opening.

6003.5 Lintel and Throat. Masonry over a fireplace opening shall be supported by a lintel of

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noncombustible material. The minimum required bearing length on each end of the fireplace opening shall be four inches (102 mm). The fireplace throat or damper shall be located a minimum of eight inches (203 mm) above the lintel.

6003.5.1 Damper. Masonry fireplaces shall be

equipped with a ferrous metal damper located at least eight inches (203 mm) above the top of the fireplace opening. Dampers shall be installed in the fireplace or the chimney venting the fireplace, and shall be operable from the room containing the fireplace.

780 CMR TABLE 6003.1

SUMMARY OF REQUIREMENTS FOR MASONRY FIREPLACES AND CHIMNEYS

ITEM	LETTER ^a	REQUIREMENTS
Hearth slab thickness	A	4"
Hearth extension (each side of opening)	B	8" fireplace opening < 6 square foot 12" fireplace opening = 6 square foot
Hearth extension (front of opening)	C	16" fireplace opening < 6 square foot 20" fireplace opening = 6 square foot
Hearth slab reinforcing	D	Reinforced to carry its own weight and all imposed loads.
Thickness of wall of firebox	E	10" solid brick or 8" where a firebrick lining is used. Joints in firebrick 1/4" maximum
Distance from top of opening to throat	F	8"
Smoke chamber wall thickness Unlined walls	G	6" 8"
Chimney Vertical reinforcing ^b (<i>For seismic consideration</i>)	H	<i>Currently not required in Massachusetts</i>
Horizontal reinforcing (<i>For seismic consideration</i>)	J	<i>Currently not required in Massachusetts</i>
Bond beams	K	No specified requirements
Fireplace lintel	L	Noncombustible material.
Chimney walls with flue lining	M	Solid masonry units or hollow masonry units grouted solid with at least 4 inch nominal thickness.
<i>Walls with unlined flue</i>	N	<i>8" solid masonry.</i>
Distances between adjacent flues	N	See 780 CMR 6001.60.
Effective flue area (based on area of fireplace opening)	P	See 780 CMR 6001.12.
Clearances: Combustible material Mantel and trim Above roof	R	See 780 CMR 6001.15 and 6003.12. See 780 CMR 6001.13. 3' at roofline and 2' at 10'.
Anchorage ^b Strap Number Embedment into chimney Fasten to Bolts	S	<i>Currently not required in Massachusetts</i>
Footing Thickness Width	T	12" min. 6" each side of fireplace wall.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 square foot = 0.0929 m².

NOTE: This table provides a summary of major requirements for the construction of masonry chimneys and fireplaces. Letter references are to 780 CMR Figure 6003.1, which shows examples of typical construction. This table does not cover all requirements, nor does it cover all aspects of the indicated requirements. For the actual mandatory requirements of the code, see the indicated section of text.

a. The letters refer to 780 CMR Figure 6003.1.

b. Currently not required in Massachusetts

The drawing consists of two main views: a Plan View at the top and a Sectional Side View below it.

Plan View: Shows the top of the fireplace opening. It is a rectangular structure with a central opening. The width of the opening is labeled as 8 IN. The overall width of the structure is labeled as 8 IN. The top of the structure is labeled BRICK and BLOCK. The bottom of the structure is labeled PLAN VIEW.

Sectional Side View: Shows a cross-section of the chimney structure. The top of the chimney is labeled MORTAR CAP. Below the cap is a BOND BEAM (K). Horizontal reinforcing ties (J) are shown. Vertical reinforcing (H) is shown. An anchor strap (S) is shown. The flue liner is shown. The bottom of the chimney is labeled HEARTH 20 IN. MIN. The footing is labeled FOOTING DEPTH (T) and FOOTING WIDTH 8 IN. AROUND FIREPLACE. The footing is made of concrete and contains bars (BARS IN CONCRETE FOOTING). The footing is labeled NATURAL GRADE. The chimney is labeled BRICK FIREBOX AND BLOCK CHIMNEY—SECTIONAL SIDE VIEW ON CONCRETE SLAB.

Labels and Dimensions:

- BRICK
- BLOCK
- 8 IN.
- WIDTH OF FIREPLACE OPENING
- PLAN VIEW
- MORTAR CAP
- (K) BOND BEAM
- (J) HORIZONTAL REINFORCING TIES
- 2 FT. MIN.
- CLEARANCE 10 FT. MIN. (R)
- FLASHING
- (S) ANCHORAGE 2 1/2 IN. BOLTS EACH STRAP
- (H) VERTICAL REINFORCING
- ANCHOR STRAP
- FLUE LINER
- CLEARANCE (H)
- 6 IN. MIN.
- (J) HORIZONTAL REINFORCING TIES
- 8 IN. MIN.
- 1/2 IN. MIN.
- 4 IN. MIN.
- (F)
- 4 IN. THICK MASONRY UN
- (H) VERTICAL REINFORCING 20 IN. LAP IF SPLICED FOOTING DOWELS
- LINTEL (L)
- (E) FIREBOX WALL THICKNESS
- FOOTING WIDTH 8 IN. AROUND FIREPLACE
- NATURAL GRADE
- HEARTH 20 IN. MIN.
- BARS IN CONCRETE FOOTING
- FOOTING DEPTH (T)
- HEARTH EXTENSION

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6003.6 Smoke Chamber. Smoke chamber walls shall be constructed of solid masonry units, hollow masonry units grouted solid, stone or concrete. Corbelling of masonry units shall not leave unit cores exposed to the inside of the smoke chamber. When a lining of firebrick at least two inches (51 mm) thick, or a lining of vitrified clay at least $\frac{5}{8}$ inch (15.9 mm) thick, is provided, the total minimum thickness of front, back and side walls shall be six inches (152 mm) of solid masonry, including the lining. Firebrick shall conform to ASTM C 27 or C 1261 and shall be laid with medium duty refractory mortar conforming to ASTM C 199. Where no lining is provided, the total minimum thickness of front, back and side walls shall be eight inches (203 mm) of solid masonry. When the inside surface of the smoke chamber is formed by corbeled masonry, the inside surface shall be parged smooth.

6003.6.1 Smoke Chamber Dimensions. The inside height of the smoke chamber from the fireplace throat to the beginning of the flue shall not be greater than the inside width of the fireplace opening. The inside surface of the smoke chamber shall not be inclined more than 45 degrees (0.39 rad) from vertical when prefabricated smoke chamber linings are used or when the smoke chamber walls are rolled or sloped rather than corbeled. When the inside surface of the smoke chamber is formed by corbeled masonry, the walls shall not be corbeled more than 30 degrees (0.26 rad) from vertical.

6003.7 Hearth and Hearth Extension. Masonry fireplace hearths and hearth extensions shall be constructed of concrete or masonry, supported by noncombustible materials, and reinforced to carry their own weight and all imposed loads. No combustible material shall remain against the underside of hearths and hearth extensions after construction.

6003.7.1 Hearth Thickness. The minimum thickness of fireplace hearths shall be four inches (102 mm).

6003.7.2 Hearth Extension Thickness. The minimum thickness of hearth extensions shall be two inches (51 mm).

Exception: When the bottom of the firebox opening is raised at least eight inches (203 mm) above the top of the hearth extension, a hearth extension of not less than $\frac{3}{8}$ -inch-thick (9.5 mm) brick, concrete, stone, tile or other approved noncombustible material is permitted.

6003.8 Hearth Extension Dimensions. Hearth extensions shall extend at least 16 inches (406 mm) in front of and at least eight inches (203 mm) beyond

each side of the fireplace opening. Where the fireplace opening is six square feet (0.557 m²) or larger, the hearth extension shall extend at least 20 inches (508 mm) in front of and at least 12 inches (305 mm) beyond each side of the fireplace opening.

6003.9 Fireplace Clearance. All wood beams, joists, studs and other combustible material shall have a clearance of not less than two inches (51 mm) from the front faces and sides of masonry fireplaces and not less than four inches (102 mm) from the back faces of masonry fireplaces. The air space shall not be filled, except to provide fire blocking in accordance with 780 CMR 6003.13.

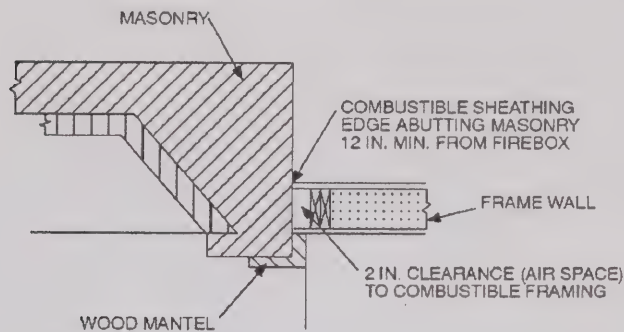
Exceptions:

1. Masonry fireplaces listed and labeled for use in contact with combustibles in accordance with UL 127 and installed in accordance with the manufacturer's installation instructions are permitted to have combustible material in contact with their exterior surfaces.
2. When masonry fireplaces are part of masonry or concrete walls, combustible materials shall not be in contact with the masonry or concrete walls less than 12 inches (305 mm) from the inside surface of the nearest firebox lining.
3. Exposed combustible trim and the edges of sheathing materials such as wood siding, flooring and drywall shall be permitted to abut the masonry fireplace side walls and hearth extension in accordance with 780 CMR Figure 6003.12, provided such combustible trim or sheathing is a minimum of 12 inches (305 mm) from the inside surface of the nearest firebox lining.
4. Exposed combustible mantels or trim may be placed directly on the masonry fireplace front surrounding the fireplace opening providing such combustible materials shall not be placed within six inches (152 mm) of a fireplace opening. Combustible material within 12 inches (306 mm) of the fireplace opening shall not project more than $\frac{1}{8}$ inch (3.2 mm) for each one-inch (25.4 mm) distance from such an opening.

6003.10 Mantel and Trim. Woodwork or other combustible materials shall not be placed within six inches (152 mm) of a fire-place opening. Combustible material within 12 inches (305 mm) of the fireplace opening shall not project more than $\frac{1}{8}$ inch (3.2 mm) for each one-inch (25.4 mm) distance from such opening (*see 780 CMR Figure 6003.2*).

6003.11 Fireplace Fireblocking. Fireplace fireblocking shall comply with the provisions of 780 CMR 5602.8.

780 CMR FIGURE 6003.2
CLEARANCE FROM COMBUSTIBLES



For SI: 1 inch = 25.4 mm.

780 CMR 6004 FACTORY-BUILT FIREPLACES

6004.1 General. Factory-built fireplaces shall be listed and labeled and shall be installed in accordance with the conditions of the listing. Factory-built fireplaces shall be tested in accordance with UL 127.

6004.2 Hearth Extensions. Hearth extensions of approved factory-built fireplaces shall be installed in accordance with the listing of the fireplace. The hearth extension shall be readily distinguishable from the surrounding floor area.

6004.3 Decorative Shrouds. Decorative shrouds shall not be installed at the termination of chimneys for factory-built fireplaces except where such shrouds are listed and labeled for use with the specific factory-built fireplace system and installed in accordance with the manufacturer's installation instructions.

6004.4 Unvented Gas Log Heaters. An unvented gas log heater shall not be installed in a factory-built fireplace unless *acceptable in accordance with the requirements of M.G.L. c. 148, § 25A, 527 CMR 30, the heater manufacturer's requirements and otherwise the fireplace system has been specifically tested, listed and labeled for such use in accordance with UL 127.*

780 CMR 6005 EXTERIOR AIR SUPPLY

6005.1 Exterior Air. Factory-built or masonry fireplaces covered in 780 CMR 60.00 shall be equipped with an exterior air supply to assure proper fuel combustion unless the room is mechanically ventilated and controlled so that the indoor pressure is neutral or positive.

6005.1.1 Factory-built Fireplaces. Exterior combustion air ducts for factory-built fireplaces shall be a listed component of the fireplace and shall be installed according to the fireplace manufacturer's instructions.

6005.1.2 Masonry Fireplaces. Listed combustion air ducts for masonry fireplaces shall be installed according to the terms of their listing and manufacturer's instructions.

6005.2 Exterior Air Intake. The exterior air intake shall be capable of providing all combustion air from the exterior of the dwelling or from spaces within the dwelling ventilated with outside air such as no mechanically ventilated crawl or attic spaces. The exterior air intake shall not be located within the garage or basement of the dwelling nor shall the air intake be located at an elevation higher than the firebox. The exterior air intake shall be covered with a corrosion-resistant screen of ¼-inch (6.4 mm) mesh.

6005.3 Clearance. Unlisted combustion air ducts shall be installed with a minimum one-inch (25.4 mm) clearance to combustibles for all parts of the duct within five feet (1524 mm) of the duct outlet.

6005.4 Passageway. The combustion air passageway shall be a minimum of six square inches (3870 mm²) and not more than 55 square inches (0.035 m²), except that combustion air systems for listed fireplaces shall be constructed according to the fireplace manufacturer's instructions.

6005.5 Outlet. The exterior air outlet is permitted to be located in the back or sides of the firebox chamber or within 24 inches (610 mm) of the firebox opening on or near the floor. The outlet shall be closeable and designed to prevent burning material from dropping into concealed combustible spaces.

780 CMR 6006 MASONRY HEATERS

6006.1 Installation. A masonry heater shall be installed according to one of the following:

1. The terms of its listing; or
2. ASTM E 1602.

**780 CMR 6007 SOLID FUEL-BURNING
APPLIANCES**

6007.1 Solid Fuel-fired Appliances, General. Solid fuel-fired appliances employed for comfort heating include, but are not limited to, room heaters and stoves, fireplace inserts, furnaces and boilers; additionally, the fuel for such appliances includes, but is not limited to wood and wood pellets, coal and various other solid fuels such as nut shells and corn, etc. Solid fuel-burning appliances shall be tested and listed by approved agencies and installed, operated and maintained in accordance with such listing, the manufacturers' requirements and otherwise conform to the requirements of 780 CMR 6007

Notes:

1. No solid fuel-burning appliance shall be installed in Massachusetts unless such appliance conforms to all applicable requirements of 780 CMR 6007, including the testing and listing of all clearances to combustibles and identification of required floor protection.

2. In the absence of explicit requirements of 780 CMR 6007, the applicable requirements of NFPA 211, as listed in Appendix A, shall apply.

6007.1.1 Listing Standards, Room Heaters, Stoves and Fireplace Inserts. Room heaters, stoves and fireplace stoves (inserts), employed for comfort heating shall be listed and tested to UL 1482 and/or ANSI/UL 737 as found in Appendix A and as applicable; all such appliances shall bear labeling as required in 780 CMR 6007.2 or 6007.3, as applicable.

6007.1.2 Listing Standards, All Pellet Fueled Solid Fuel-burning Appliances. All pellet solid fuel-burning appliances sold for use in Massachusetts shall be tested and listed to ASTM E 1509 as found in Appendix A and shall bear such labeling as required in 780 CMR 6007.2.

6007.2 Solid Fuel-burning Appliance Labeling (Not Central Heating Appliances). Every solid fuel-burning appliance utilized for comfort heating shall bear a permanent and legible factory-applied label supplied to the manufacturer and controlled by an approved testing agency; such label shall contain the following information:

1. Manufacturer's name and trademark;
2. Model and/or identification number of the appliance;
3. Type(s) of fuel(s) approved;
4. Testing laboratory's name or trademark and location;
5. Date tested;
6. Clearances to combustibles:
 - (a) Above top
 - (b) From front

- (c) From back
- (d) From sides
7. Floor protection;
8. National test (listing) standard(s); and
9. Label serial number.

6007.3 Solid Fuel-burning Central Heating Appliance Labeling. Every solid fuel-burning boiler or warm air furnace shall bear a permanent and legible factory-applied label supplied to the manufacturer and controlled by an approved testing agency; such label shall contain the following information:

1. Manufacturer's name and trademark;
2. Model and/or identification number of the appliance;
3. Type(s) of fuel(s) approved;
4. Testing laboratory's name or trademark and location;
5. Date tested;
6. Clearances to combustibles:
 - (a) Above top
 - (b) From front
 - (c) From back
 - (d) From sides
7. Floor protection, if applicable;
8. National test standard(s);
9. Label serial number;
10. Type of appliance (boiler or warm air furnace);
11. Every boiler, pressure vessel or pressure relief device must be stamped in accordance with the requirements of the ASME Boiler and Pressure Vessel Code. ASME stamping shall also be required for boilers, pressure vessels and pressure relief devices produced outside the United State of America. Where required by the ASME Boiler and Pressure Vessel Code, ASME stamping may be affixed directly to the appliance in lieu of on the data plate.

6007.4 Hazardous Locations. Solid fuel-burning appliances shall not be installed in hazardous locations (any location considered to be a fire hazard for flammable vapors, dust, combustible fibers or other highly combustible substances).

Exception: Solid fuel-fired appliances listed for such locations.

6007.5 Air for Combustion and Ventilation. Solid fuel-burning appliances shall be installed in a location and manner to assure satisfactory combustion of fuel, proper chimney draft and maintenance of safe operating temperatures. Combustion air may be obtained from interior spaces when the interior space containing the appliance has a volume, in cubic feet equal to $\frac{1}{20}$ of the output Btu rating of all fuel-burning appliances in the space. When buildings are so tight as to preclude adequate infiltration, provisions shall be made to introduce outside air for combustion and ventilation.

CHIMNEYS, FIREPLACES AND SOLID FUEL-BURNING APPLIANCES

6007.6 Chimney Connection. All solid fuel-burning appliances shall be connected to chimneys in accordance with their listing, the manufacturer's requirements and the requirements of 780 CMR 60.00, as applicable.

Exception: Solid fuel-burning appliances listed for exhaust vent termination other than through a chimney shall be vented in accordance with the manufacturer's requirements.

6007.6.1 Chimney Connector Clearance to Combustibles – Solid Fuel-burning Appliances Only. Refer to 780 CMR Table 6007.6.1.

780 CMR TABLE 6007.6.1^{1,2}
CHIMNEY AND/OR VENT CONNECTOR
CLEARANCES TO COMBUSTIBLE
MATERIALS/SOLID FUEL-BURNING
APPLIANCES ONLY

DESCRIPTION OF APPLIANCE	CONNECTOR TYPE	MINIMUM CLEARANCE (in)	MINIMUM CLEARANCE (mm)
Residential-type appliances	Single-wall metal pipe connector	18	457
Residential-type appliances	Type L vent piping connector	9	229
Low-heat appliances boilers, furnaces, water heaters	Single-wall metal pipe connector	18	457
Medium-heat appliances	Single-wall metal pipe connector	36	914
High-heat appliances	Masonry or metal connector	Note 3	Note 3

1. For greater detail and guidance, refer to NFPA 211, Section 6-5.
2. For chimney connectors tested and listed for other clearances to combustibles, such tested, listed clearances shall apply.
3. Clearances shall be based on engineering calculations and good engineering practice. Refer to NFPA 211, Section 6-5. **6007.7 Chimney flue size.** For solid fuel-burning comfort heating appliances for one- and two-family use, the cross-sectional area of the flue shall not be less than the cross-sectional area of the appliance flue collar. The cross-sectional area of the flue shall not be more than three times the cross-sectional area of the flue collar of the appliance.

6007.8 Connection to Masonry Fireplaces. A solid fuel-burning appliance such as a stove or fireplace insert shall be permitted to use a masonry fireplace flue where the following conditions are met:

1. There is a connector that extends from the appliance to the flue liner;
2. The cross-sectional area of the flue is no more than three times the cross-sectional area of the flue collar of the appliance but never less

than the appliance exhaust collar cross-sectional area;

3. If the appliance vents directly through the chimney wall above the smoke chamber of the fireplace, there shall be a noncombustible seal below the entry point of the connector, sealing the fireplace from the appliance;

4. The installation shall be such that the chimney system can be inspected and cleaned; and

5. Means shall be provided to prevent dilution of combustion products in the chimney flue with air from the habitable space.

6007.9 Mounting (Placing) of Residential Solid Fuel-burning Appliances. Residential type solid fuel-burning appliances shall be tested and listed by approved agencies and such appliances, when mounted (placed) on combustible or noncombustible materials, shall be installed in accordance with their listing and the manufacturer's requirements.

Exceptions: See NFPA 211, Section 9-5.1.1.1 (all such exceptions pertain to placing of such appliances on well supported concrete bases, concrete slabs, properly stabilized, noncombustible soils or on approved, noncombustible assemblies of two hour fire resistance with floors constructed of noncombustible materials).

6007.10 Floor Protection. Floor protection shall satisfy all listing requirements.

6007.10.1 Floor Protectors-Definition. Floor protectors are noncombustible surfacing applied to the combustible or noncombustible floor area underneath and extending in front, to the sides and to the rear of a heat producing appliance. For purposes of 780 CMR 6007.9, floor protectors must be noncombustible and have the necessary thermal conductivity to satisfy the appliance tested/listing floor protection requirements.

Notes:

1. Refer to Appendix W (780 CMR 120.W) for information on floor protector thermal conductivity calculations
2. Various "hearth rugs," "mats," "tile board," "hearth board" and similar products sold as floor protectors may be noncombustible but may not satisfy thermal conductivity requirements to comply with 780 CMR 6007 and manufacturer's requirements.

780 CMR TABLE 6007.11^{1,2,3}
STANDARD CLEARANCES TO COMBUSTIBLES FOR SOLID FUEL-BURNING APPLIANCES

APPLIANCE TYPE	CLEARANCE ABOVE TOP OF APPLIANCE (inches)	CLEARANCE FROM FRONT OF APPLIANCE (inches)	CLEARANCE FROM BACK OF APPLIANCE (inches)	CLEARANCE FROM SIDES OF APPLIANCE (inches)
Room heaters; fireplace stoves; combination	36	36	36	36

For SI: 1 inch = 25.4 mm.

1. For reduced clearance requirements, see 780 CMR 6007.11.1
2. Adequate clearance for maintenance and cleaning shall be provided.
3. Provisions for solid fuel storage—solid fuel shall not be stored any closer than 36 inches from the sides, front or back of the solid fuel-burning appliance.

6007.11 Appliance Clearances. Solid fuel-burning appliances shall be installed in accordance with the manufacturer's tested, listed clearances (also see 780 CMR 6007.14.1 for used solid fuel-burning appliance clearance requirements).

6007.11.1 Clearance Reductions. Tested, listed clearances to combustibles shall only be permitted to be reduced in accordance with the requirements of NFPA 211, Sections 9-6.1 and 9-6.2.

Note that an engineered protection system is required to achieve a reduced clearance installation except when appliances are installed in rooms that are large in comparison to the size of the appliance (see NFPA 211, Section 9-6.1).

6007.12 Supply Ducts. When a solid fuel-burning appliance utilizes supply ducts such ducts conveying heated air shall be fabricated of noncombustible materials.

Exception: Combustible ducts specifically tested and listed for such purpose.

6007.12.1 Supply Duct Clearance to Combustibles. Supply ducts conveying heated air shall have a clearance to combustibles of not less than 12 inches (305 mm) for the first ten feet (3048 mm) of distance from the appliance plenum/bonnet.

Exception: Ducts specifically tested and listed for such purpose.

6007.13 Multiple Flue Connections. A solid fuel-burning appliance and a fossil fuel-burning appliance shall not be vented into a common flue of a masonry chimney unless such common connection is allowed by 248 CMR or 527 CMR as applicable and otherwise by 780 CMR 6007 generally. If allowed, the common flue shall be of such size to serve all appliances connected if such appliances were operated simultaneously.

Note that 248 CMR and 527 CMR are enforced by gas inspectors and the heads of fire departments, respectively.

6007.13.1 Multiple Flue Connections Not Allowed with Solid Fuel Appliances. A solid fuel-burning appliance shall not share a common flue with a working fireplace nor with

another solid fuel-burning appliance.

6007.14 Used Solid Fuel-burning Appliances – Installation Inspection. Used solid fuel-burning appliances that predate the listing requirements set forth in this code may be utilized but the installation of such appliances shall otherwise conform to the requirements of 780 CMR 60.00, as applicable and such installations shall be inspected by the building official (or fire official in such towns that utilize the fire official for such inspection purposes).

6007.14.1 Used Solid Fuel-burning Appliance Clearances to Combustibles. In the absence of tested, listed clearances and floor protection requirements, used solid fuel-burning appliances shall be required to be installed in accordance with the clearances of 780 CMR 6007.11. Floor protection requirements shall be evaluated by engineering methods or otherwise four inches (102 mm) of millboard having a thermal conductivity of:

$$k = 0.84 \text{ (Btu) (inch)/(foot}^2 \text{) (hour) (}^{\circ}\text{F)}$$

or an equivalent noncombustible floor protector of the same overall thermal conductivity shall be required (also see 780 CMR 6007.10.1).

Exceptions:

1. If tested, listed clearances and/or floor protection requirements are documentable for the specific used appliance being installed, then such clearances and/or floor protection may be utilized.
2. If known tested, listed clearances are greater than those of 780 CMR 6007.11, then such clearances must be maintained.
3. If existing floor protection can be demonstrated to have been adequate for previous installations of said used solid fuel-burning appliances, then such previously utilized floor protection shall be allowed. If calculations demonstrate that the existing floor protection has a thermal conductivity lower than that set by 780 CMR 6007.14.1 and adequacy has otherwise been demonstrated, then the existing floor protection must be maintained.

780 CMR 6008 FIREPLACE STOVES

6008.1 General. Fireplace stoves shall be listed, labeled and installed in accordance with the terms of the listing. Fireplace stoves shall be tested in accordance with UL 737.

6008.2 Hearth Extensions. Hearth extensions for fireplace stoves shall be installed in accordance with the listing of the fireplace stove. The supporting structure for a hearth extension for a

fireplace stove shall be at the same level as the supporting structure for the fireplace unit. The hearth extension shall be readily distinguishable from the surrounding floor area.

780 CMR 6009 MASONRY HEATERS

6009.1 General. Masonry heaters shall be constructed in accordance with 780 CMR 6006.

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NON-TEXT PAGE

780 CMR 61.00

ENERGY EFFICIENCY

(Note: Chapter 61 is unique to Massachusetts)

780 CMR 6101 SCOPE AND GENERAL REQUIREMENTS

6101.1 Intent. The provisions of 780 CMR 61.00 shall regulate the design and construction of building envelopes for adequate thermal resistance, low air leakage and water vapor control, and the design and selection of mechanical, electrical and service water-heating systems and equipment which will enable effective use of energy in new one- and two-family building construction. It is intended that these provisions provide flexibility to permit the use of innovative approaches and techniques to achieve effective utilization of energy. 780 CMR 51.00 through 99.00 is not intended to abridge safety, health or environmental requirements under other applicable codes or ordinances.

6101.2 Compliance. Envelope design compliance with 780 CMR 51.00 through 99.00 shall be determined in accordance with one of the following alternatives:

1. 780 CMR 6107.2, Building design by prescriptive package;
2. 780 CMR 6107.3, Building design by approved software;
3. 780 CMR 6108, Building design by systems analysis and design of buildings utilizing renewable energy resources; or
4. 780 CMR 6109, Building design by home energy rating.

6101.3 Scope. 780 CMR 61.00 sets forth energy-efficiency requirements for the design and construction of new one- and two-family residential occupancy buildings.

Note 1: 780 CMR 61.00 may also be used for compliance of envelope and mechanical, electrical and service water-heating systems in new residential buildings three stories or less in height.

Note 2: 780 CMR 61.00 may also be used for envelope compliance in new buildings other than residential occupancies three stories or less in height, if the total conditioned floor area does not exceed 10,000 square feet (929 m²) (per 780 CMR 1301.2 of the *Sixth Edition, Massachusetts Building Code*). In such cases, HVAC, service water-heating, power distribution and lighting systems must satisfy the requirements of 780 CMR 13.00 of the *Sixth Edition, Massachusetts Building Code*.

6101.3.1 Exempt Buildings. Buildings and structures indicated in 780 CMR 6101.3.1.1 through 6101.3.1.4 shall be exempt from the

provisions of 780 CMR 51.00 through 99.00.

6101.3.1.1 Separated Buildings. Buildings and structures, or portions thereof, separated by building envelope assemblies from the remainder of the building, that have a peak design rate of energy usage less than 3.4 Btu/h per square foot (10.7 W/m²) or 1.0 watt per square foot (10.7 W/m²) of floor area for all purposes.

6101.3.1.2 Unconditioned Spaces. Buildings or portions thereof which are not conditioned, per the definition in 780 CMR 52.00.

6101.3.1.3 Greenhouses used Exclusively for Agricultural Purposes. Greenhouses that are free-standing, or attached to a building and separated by a wall having the same thermal value as an exterior wall, and provided with a separate temperature control system.

6101.3.1.4 Small Buildings. Buildings with less than 100 square feet (9.3 m²) of gross floor area.

6101.3.2 Applicability. The provisions of 780 CMR 61.00 shall apply to all matters affecting or relating to structures and premises, as set forth in 780 CMR 6101. Where, in a specific case, different sections of 780 CMR 51.00 through 99.00 specify different materials, methods of construction or other requirements, the most restrictive shall govern.

6101.3.2.1 Existing Buildings. For alterations to existing buildings, see 780 CMR 6101.3.2.2 and 780 CMR 93.00.

6101.3.2.2 Additions to Existing Buildings. Additions to existing buildings or structures shall comply with one of the applicable criteria below:

1. The new addition, by itself, shall conform to the applicable provisions of 780 CMR 61.00;
2. The new addition plus the existing building/dwelling unit may be considered together for compliance with all applicable provisions of 780 CMR 61.00; or
3. Additions that are open to or separated by an exterior wall from the existing building/dwelling unit shall meet the prescriptive envelope component criteria of 780 CMR Table 6101.3. The total area (based on rough opening dimensions) of glazed fenestration products (windows, skylights and glazed portion of doors) shall not exceed 40% of the gross wall and gross

ceiling/roof area of the addition combined. If any individual fenestration component exceeds the maximum U-factor listed in 780 CMR Table 6101.3, then the area-weighted average U-factor for all fenestration components must be less than or equal to the listed value. The R-value requirements for opaque thermal envelope components indicate insulation products (cavity and/or insulating sheathing), and shall be equal to or exceed the applicable listed values found in 780 CMR Table 6101.3. If such addition is separated from the main house by a wall or doors and is conditioned, then a readily accessible manual or automatic means shall be provided to partially restrict or shut off the heating and/or cooling input to the addition space. That portion of a wall that separates the addition from the existing building/dwelling unit, if an existing exterior wall, shall be allowed to remain, and neither that portion of said wall nor any fenestration within said portion of wall common to the addition need comply with the thermal envelope requirements of 780 CMR 61.00.

Exception: Sunroom Additions/ Consumer Notification: Sunrooms, as defined in 780 CMR 52.00, shall be exempt from the compliance requirements set forth in 780 CMR 6101.3.2.2 and 6101.2, provided that the actual property owner (not the owner's agent or representative) of the structure onto which the sunroom addition is being made, provides a signed copy of the sunroom "CONSUMER INFORMATION FORM" (found in 780 CMR 120.P) to the Building Department. This signed "CONSUMER INFORMATION FORM" shall be submitted to the building official as a requirement of building permit issuance, and shall remain as part of the construction documents. If such sunroom additions are separated from the main house by a wall and are conditioned spaces, then a readily accessible manual or automatic means shall be provided to partially restrict or shut off the heating and/or cooling input to the sunroom addition space. That portion of a wall that separates the sunroom addition from the existing building/dwelling unit, if an existing exterior wall, shall be allowed to remain, and neither that portion of said wall on any fenestration within said portion and common to the sunroom addition, need comply with the thermal envelope requirements of 780 CMR 61.00.

780 CMR TABLE 6101.3
PRESCRIPTIVE ENVELOPE COMPONENT
CRITERIA ADDITIONS TO EXISTING
LOW-RISE RESIDENTIAL BUILDINGS

MAXIMUM		MINIMUM			
Fenestration U-factor	Ceilings and exposed floors R-Value	Wall R-Value	Floor R-Value	Basement Wall R-Value	Slab Perimeter R-Value and Depth
0.39	R-37*	R-13	R-19	R-10	R-10, 4 feet

For SI: 1 foot = 304.8 mm.

a. R-30 ceiling insulation may be used in place of R-37 if the insulation achieves the full R-value over the entire ceiling area (i.e., not compressed over exterior walls, and including any access openings).

6101.3.2.3 Historic Buildings. Historic buildings, as defined in 780 CMR 9309 of 780 CMR 51.00 through 99.00, are exempt from the requirements of 780 CMR 61.00.

6101.3.2.4 Change in Occupancy. A change in the occupancy or change in use of an existing building or structure shall be permitted, subject to the applicable provisions of 780 CMR 93.00.

780 CMR 6102 MATERIALS, SYSTEMS AND EQUIPMENT

6102.1 General. Materials, equipment and systems shall be identified in a manner that will allow a determination of their compliance with the applicable provisions of 780 CMR 61.00.

6102.2 Materials, Equipment and Systems Installation. All insulation materials, caulking and weatherstripping, fenestration assemblies, mechanical equipment and systems components, and water-heating equipment and system components shall be installed in accordance with the manufacturer's installation instructions.

6102.3 Maintenance Information. Required regular maintenance actions shall be clearly stated and incorporated on a readily accessible label on the equipment or made otherwise available for permanent reference. Such label shall include the title or publication number, the operation and maintenance manual for that particular model and type of product. Maintenance instructions shall be furnished for equipment that requires preventive maintenance for efficient operation.

6102.4 Insulation Installation. Roof/ceiling, floor, wall cavity and duct distribution system insulation shall be installed in a manner that permits inspection of the manufacturer's R-value identification mark.

6102.4.1 Protection of Exposed Foundation Insulation. Insulation applied to the exterior of foundation walls and around the perimeter of slab-on-grade floors shall have a rigid, opaque and weather-resistant protective covering to prevent

the degradation of the insulation's thermal performance. The protective covering shall cover the exposed area of the exterior insulation and extend a minimum of six inches (153 mm) below grade.

6102.5 Identification. Materials, equipment and systems shall be identified in accordance with 780 CMR 6102.5.1, 6102.5.2 and 6102.5.3.

6102.5.1 Building Envelope Insulation. A thermal resistance (R) identification mark shall be applied by the manufacturer to each piece of building envelope insulation 12 inches (305 mm) or greater in width.

Alternatively, the insulation installer shall provide a signed and dated certification for the insulation installed in each element of the building envelope, listing the type of insulation installations in roof/ceilings, the manufacturer and the R-value. For blown-in or sprayed insulation, the installer shall also provide the initial installed thickness, the settled thickness, the coverage area and the number of bags installed. Where blown-in or sprayed insulation is installed in walls, floors and cathedral ceilings, the installer shall provide a certification of the installed density and R-value. The installer shall post the certification in a conspicuous place on the job site.

6102.5.1.1 Roof/Ceiling Insulation. The thickness of roof/ceiling insulation that is either blown in or sprayed shall be identified by thickness markers that are labeled in inches or millimeters installed at least one for every 300 square feet (28 m²) throughout the attic space. The markers shall be affixed to the trusses or joists and marked with the minimum initial installed thickness and minimum settled thickness with numbers a minimum of one inch (25 mm) in height. Each marker shall face the attic access. The thickness of installed insulation shall meet or exceed the minimum initial installed thickness shown by the marker.

6102.5.2 Fenestration Product Rating, Certification and Labeling. U-factors of fenestration products (windows, doors and skylights) shall be determined in accordance with NFRC 100 by an accredited, independent laboratory, and labeled and certified by the manufacturer. Such certified and labeled U-factors shall be accepted for purposes of determining compliance with the building envelope requirements of 780 CMR 61.00

When a manufacturer has not determined product U-factor in accordance with NFRC 100 for a particular product line, compliance with the building envelope requirements of 780 CMR 51.00 through 99.00 shall be determined by assigning such products a default U-factor in accordance with 780 CMR Tables 6102.5.2(1) and 6102.5.2(2). Product features must be verifiable for the product to qualify for the default

value associated with those features. Where the existence of a particular feature cannot be determined with reasonable certainty, the product shall not receive credit for that feature. Where a composite of materials from two different product types is used, the product shall be assigned the higher U-factor.

6102.5.3 Duct Distribution Systems Insulation.

A thermal resistance (R) identification mark shall be applied by the manufacturer in maximum intervals of no greater than ten feet (3048 mm) to insulated flexible duct products showing the thermal performance R-value for the duct insulation itself (excluding air films, vapor retarders or other duct components).

780 CMR TABLE 6102.5.2(1)

U-FACTOR DEFAULT TABLE FOR WINDOWS, GLAZED DOORS AND SKYLIGHTS

FRAME MATERIAL AND PRODUCT TYPE ^a	SINGLE GLAZED	DOUBLE GLAZED
Metal without thermal break		
Operable (including sliding and swinging glass doors)	1.27	0.87
Fixed	1.13	0.69
Garden window	2.6	1.81
Curtain wall	1.22	0.79
Skylight	1.98	1.31
Site-assembled sloped/overhead glazing	1.36	0.82
Metal with thermal break		
Operable (including sliding and swinging glass doors)	1.08	0.65
Fixed	1.07	0.63
Curtain wall	1.61	0.68
Skylight	1.89	1.61
Site-assembled sloped/overhead glazing	1.25	0.7
Reinforced vinyl/metal clad wood		
Operable (including sliding and swinging glass doors)	0.9	0.57
Fixed	0.98	0.56
Skylight	1.75	1.05
Wood/vinyl/fiberglass		
Operable (including sliding and swinging glass doors)	0.89	0.55
Fixed	0.98	0.56
Garden window	2.31	1.61
Skylight	1.47	0.84

a. Glass block assemblies with mortar but without reinforcing or framing shall have a U-factor of 0.60.

780 CMR TABLE 6102.5.2(2)

U-FACTOR DEFAULT TABLE FOR NONGLAZED DOORS

DOOR TYPE	WITH FOAM CORE	WITHOUT FOAM CORE
Steel doors (1.75 inches thick)	0.35	0.6
	WITHOUT STORM DOOR	WITH STORM DOOR
Wood doors (1.75 inches thick)		
Panel with 0.438-inch panels	0.54	0.36
Hollow core flush	0.46	0.32
Panel with 1.125-inch panels	0.39	0.28
Solid core flush	0.4	0.26

For SI: 1 inch = 25.4 mm.

780 CMR 6103 ALTERNATE MATERIALS — METHOD OF CONSTRUCTION, DESIGN OR INSULATING SYSTEMS

6103.1 General. The provisions of 780 CMR 51.00 through 99.00 are not intended to prevent the use of any material, method of construction, design or insulating system not specifically prescribed herein, provided that such construction, design or insulating system has been approved, if necessary, by the BBRS as meeting the intent of the code.

Compliance with specific provisions of 780 CMR 51.00 through 99.00 shall be determined through the use of computer software, worksheets, compliance manuals and other similar materials when they have been approved by the BBRS as meeting the intent of 780 CMR 51.00 through 99.00.

780 CMR 6104 CONSTRUCTION DOCUMENTS

6104.1 General. Construction documents and other supporting data shall be submitted in one or more sets with each application for a permit. The construction documents and designs submitted under the provisions of 780 CMR 6108 shall be prepared by a registered design professional. Where special conditions exist, the building official is authorized to require additional construction documents to be prepared by a registered design professional.

6104.2 Information on Construction Documents. Construction documents shall be drawn to scale upon suitable material. Electronic media documents are permitted to be submitted when approved by the building official. Construction documents shall be of sufficient clarity to indicate the location, nature and extent of the work proposed and show in sufficient detail pertinent data and features of the building and the equipment and systems as herein governed, including, but not limited to, design criteria, exterior envelope component materials, U-factors of fenestration products, R-values of insulating materials, size and type of apparatus and equipment, equipment and systems controls and other pertinent data to indicate conformance with the requirements of 780 CMR 51.00 through 99.00

If using 780 CMR 6107.3 (Building design by approved software), a window schedule including the areas (based on rough opening), and the number of windows, skylights and other glazed fenestration, shall also be submitted.

When HVAC equipment sizing information is not available at the time of initial building permit application, such information shall be submitted prior to the installation of said equipment, and supporting calculations shall demonstrate compliance with 780 CMR 6106.4.3.1.1. Installed equipment must meet or exceed the efficiency rating listed in the submitted construction documents.

780 CMR 6105 DESIGN CRITERIA

6105.1 General. The criteria of 780 CMR 61.00 establish the design conditions for use with all sections of 780 CMR 61.00.

6105.2 Exterior Design Conditions. Exterior design parameters to be used for calculations required under 780 CMR 51.00 through 99.00 shall be taken from 780 CMR Table 6105.1, based on the climate zones defined in 780 CMR Table 6105.2.

780 CMR TABLE 6105.1
CLIMATE ZONE THERMAL DESIGN CRITERIA

CLIMATE ZONE #	12a	13a	14a
Winter, Design Dry-bulb (°F)	9	7	-1
Summer, Design Dry-bulb (°F)	86	87	86
Summer, Design Wet-bulb (°F)	74	74	73
Heating Degree Days Base 65	5,884	5,641	6,894
Heating Degree Days Base 50	2,553	2,399	3,448
Cooling Degree Days Base 65	606	678	507
Cooling Degree Days Base 50	2,743	2,897	2,525
Cooling Degree Hours Base 80	939	1299	409

780 CMR TABLE 6105.2
CLIMATE ZONE BY COUNTY

COUNTY	CLIMATE ZONE #
Barnstable	12a
Berkshire	14a
Bristol	12a
Dukes	12a
Essex	13a
Franklin	14a
Hampden	14a
Hampshire	14a
Middlesex	13a
Nantucket	12a
Norfolk	13a
Plymouth	12a
Suffolk	13a
Worcester	14a

6105.3 Indoor Design Conditions. Indoor design temperature and relative humidity shall be determined in accordance with ASHRAE Standard 55, and shall be selected for minimum total HVAC system energy use in accordance with accepted practice.

6105.4 Ventilation. Living space fresh air ventilation shall conform to the requirements of 780 CMR 5303.

Exception: If outdoor air quantities other than those specified in the *International Mechanical Code* are used or required because of special occupancy requirements, source control of air contamination, health and safety, or other standards, the required outdoor air quantities shall be used as the basis for calculating the heating and cooling design loads.

780 CMR 6106 GENERAL REQUIREMENTS**6106.1 Scope.**

6106.1.1 General. All buildings or portions thereof that are conditioned and meet the provisions of 780 CMR 61.00 using the compliance paths of 780 CMR 6107.2 or 6107.3 shall also meet the requirements of 780 CMR 6106. Buildings that meet the provisions using the compliance paths of 780 CMR 6108 or 6109 are exempt from the requirements of 780 CMR 6106.

Exception: All buildings must comply with the requirements of 780 CMR 6106.2.1

6106.2 Building Envelope Requirements.

6106.2.1 Vapor Retarder. The design shall not create conditions of accelerated deterioration from moisture condensation. In all frame walls, floors, ceilings and roofs, an approved vapor retarder having a maximum rating of 1.0 perm, when tested in accordance with Standard ASTM E 96, as listed in 780 CMR Appendix A, shall be installed on the warm-in-winter side of the thermal insulation.

Exceptions:

1. Where it can be demonstrated to the satisfaction of the building official that the absence of a vapor retarder will not damage the materials or adversely affect the performance of the insulation due to moisture or its freezing.
2. As allowed in 780 CMR 5806.1.

6106.2.2 Basements. When the basement is a conditioned space, the basement walls shall be insulated. When the basement is not a conditioned space, either the basement walls or the ceilings separating the basement from conditioned space shall be insulated. When insulating basement walls, the required R-value shall be applied from the top of the basement wall to a depth of ten feet (3048 mm) below grade or to the top of the basement floor, whichever is less.

6106.2.3 Slab-on-grade Floors. For slabs in heated or cooled areas, when the top edge of the slab is above finished grade, or 12 inches (305 mm) or less below finished grade, the required R-value (as determined by 780 CMR 6107.2, 6107.3, 6108 or 6109) shall be applied to the outside of the foundation or the inside of the foundation wall. The insulation shall extend downward from the top of the slab, or downward to the bottom of the slab and then horizontally in either direction, until reaching the required distance as determined by 780 CMR 6107.2, 6107.3, 6108 or 6109.

When installed between the exterior wall and the edge of the interior slab, the top edge of the insulation shall be permitted to be cut at a 45-degree (0.79 rad) angle away from the exterior

wall. Insulation extending horizontally away from the building shall be protected by pavement or by a minimum of ten inches (254 mm) of soil.

An additional R-2 of insulation shall be added to the required values (as determined by 780 CMR 6107.2 or 6107.3) where uninsulated hot water pipes, air distribution ducts or electric heating cables are installed within or under the slab.

6106.2.4 Crawl Space Walls. Where the floor above a crawl space is uninsulated, insulation shall be installed on crawl space walls, and the crawl space shall not be vented to outside air. The required R-value (as determined by 780 CMR 6107.2, 6107.3, 6108 or 6109) shall be applied inside of the crawl space wall, downward from the sill plate to the exterior finished grade level and then vertically and/or horizontally for at least an additional 24 inches (610 mm). Where a crawl space is vented to outside air, the floor above the crawl space shall be insulated to a minimum of R-19, and a protective barrier shall be installed to prevent wind from moving into the insulation. The exposed earth in all crawl space foundations shall be covered with a continuous vapor retarder having a maximum permeance rating of 1.0 perm $[(57 \text{ mg})/(\text{s} \cdot \text{m}^2 \cdot \text{Pa})]$ when tested in accordance with ASTM E 96, and the vapor retarder shall be sealed to prevent moisture migration.

6106.2.5 Access Openings. Access doors, hatches, scuttles, pull down staircases and similar constructions that are part of the building envelope shall be insulated to a level equivalent to the insulation of the surrounding floor, wall and ceiling.

Exception: If the access opening has less insulation than the surrounding area, for calculation purposes the R-value of the surrounding floor, wall and ceiling shall be increased accordingly.

6106.2.6 Masonry Veneer. When insulation is placed on the exterior of a foundation supporting a masonry veneer exterior, the horizontal foundation surface supporting the veneer is not required to be insulated to satisfy the foundation insulation requirement.

6106.2.7 Return-air Ceiling Plenums. When return-air ceiling plenums are employed, the roof/ceiling assembly shall:

1. For thermal transmittance purposes, not include the ceiling proper nor the plenum space as part of the assembly; and
2. For gross area purposes, be based upon the interior face of the upper plenum surface.

6106.3 Air Leakage.

6106.3.1 General. The requirements of 780 CMR 6106.3 shall apply to those locations separating outdoor ambient conditions or exempted portions of the building (e.g., attics,

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unconditioned basements) from interior conditioned spaces, and where infiltration of outdoor air can affect the performance of materials (e.g., attic insulation). The requirements are not applicable to the separation of interior conditioned spaces from each other.

6106.3.2 Window and Door Assemblies.

Exterior doors and windows shall be designed to limit air leakage into and from the building envelope. Manufactured doors and windows shall comply with the maximum allowable infiltration rates in 780 CMR Table 6106.3.2

Exception: Site-constructed windows and doors sealed in accordance with 780 CMR 6106.3.3.

780 CMR TABLE 6106.3.2**ALLOWABLE AIR INFILTRATION RATES^a**

WINDOWS (cfm per square foot of window area)	DOORS (cfm per square foot of door area)	
	Sliders	Swinging
0.3 ^{b,c}	0.3	0.5 ^d

- When tested in accordance with ASTM E 283, as listed in 780 CMR 100.00.
- See standard AAMA/WDMA 101/I.S.2, as listed in 780 CMR 100.00.
- See standard ASTM D 4099, as listed in 780 CMR 100.00.
- See standards AAMA 101V and ASTM D 4099, each as listed in 780 CMR 100.00.

6106.3.3 Building Envelope. The building envelope shall be designed and constructed to reduce air leakage into or out of conditioned spaces. Sealant materials shall be compatible with the construction materials, location and anticipated conditions. Sealant materials spanning joints between dissimilar construction materials shall be joined in a flexible manner to create a continuous barrier to control accidental infiltration through assemblies, allowing for the relative movement of materials due to thermal and moisture variations and creep.

Joints, seams or penetrations in the building envelope that are sources of air leakage shall be sealed with durable caulking materials, closed with gasketing systems, taped or covered with moisture vapor-permeable house-wrap per manufacturer's directions. Air leakage locations to be treated shall include:

- Between wall assemblies or their sill-plates and foundations;
- Openings, cracks and joints between framing members and window or door frames;
- Between walls and roof/ceilings or

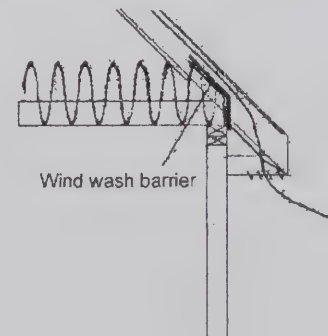
attic/ceiling seals and between separate wall panels;

- Between walls and floor assemblies;
- Penetrations of utility services through walls, floors and roof assemblies;
- Penetration through the wall cavity of top and/or bottom plates; and
- All other such openings in the building envelope. This includes sealing behind tubs and showers on exterior walls, at the attic and crawl space access panels, at recessed lights and around all plumbing, electrical and HVAC penetrations.

6106.3.3.1 Exterior Wind Wash Barrier. In ventilated attics or roofs, a rigid wind wash barrier must be tightly installed at the exterior edge of the exterior wall top plate (i.e., the eave area), extending vertically to the height of the uncompressed insulation of to within 3.5 inches (89 mm) of the underside of the roof deck, to maintain the required ventilation space. See 780 CMR Figure 6106.3.3.1.

6106.3.4 Recessed Lighting Fixtures. When installed in the building envelope, recessed lighting fixtures shall meet one of the following requirements:

- Type IC rated, manufactured with no penetrations between the inside of the recessed fixture and ceiling cavity and sealed or gasketed to prevent air leakage into the unconditioned space.
- Type IC rated, with no more than 2.0 cfm (0.944 L/s) air movement from the conditioned space to the ceiling cavity, when tested in accordance with ASTM E 283 at 1.57 lbs/ft.² (75 Pa) pressure difference. Such fixtures shall be labeled to document compliance.

**780 CMR FIGURE 6106.3.3.1
WIND WASH BARRIER**

6106.4 Building Mechanical Systems.

6106.4.1 General. 780 CMR 6106.4 covers mechanical systems and equipment used to provide heating, ventilating and air-conditioning functions. 780 CMR 6106.4 assumes that residential buildings and dwelling units therein will be designed with individual HVAC systems. Where equipment not shown in 780 CMR Table 6106.4 is specified, it shall meet the applicable provisions of 780 CMR 13.00 of the *Sixth Edition, Massachusetts Building Code*.

6106.4.2 Mechanical Equipment Efficiency. Equipment shown in 780 CMR Table 6106.4 shall meet the specified minimum performance. Data furnished by the equipment supplier, or certified under a nationally recognized certification procedure, shall be used to satisfy these requirements. All such equipment shall be installed in accordance with the manufacturer's instructions.

6106.4.3 HVAC Systems. HVAC systems shall meet the criteria set forth in 780 CMR 6106.4.3.1 through 6106.4.3.3.

6106.4.3.1 Load Calculations. Heating and cooling system design loads for the purpose of sizing systems and equipment shall be determined in accordance with the procedures described in the *ASHRAE Handbook of Fundamentals* or the *Air Conditioning*

Contractors Association's Manual "J," or other procedure approved by the BBRS, using the design parameters specified in 780 CMR 6105.

6106.4.3.1.1 System Heating and Cooling Capacity. The rated output capacity of the heating/cooling system at design conditions shall not be greater than 125% of the design load calculated in accordance with 780 CMR 6106.4. Capacity shall be, within available equipment options, the smallest size necessary to meet the load.

Exceptions:

1. If the rated output capacity of available equipment options exceeds 125% of the design load, then equipment with the smallest output capacity above 125% of the load shall be utilized.
2. In multiple-family buildings, where the HVAC system for the building uses interconnected equipment designed to sequence with the load and it can be shown that such design will use less energy on an annual basis than one large unit.
3. In multiple-family buildings, equipment designed for standby purposes is not included in the capacity limitation requirement.

**780 CMR TABLE 6106.4
MINIMUM EQUIPMENT PERFORMANCE**

EQUIPMENT CATEGORY	SUBCATEGORY*	REFERENCED STANDARD	MINIMUM PERFORMANCE ^f
Air-cooled heat pumps heating mode < 65,000 Btu/h cooling capacity, single phase	Split systems and single package	ARI 210/240	7.7 HSPF ^{a,b}
	Through-the-wall split systems		7.1 HSPF ^{a,b}
	Through-the-wall single package		7.0 HSPF ^{a,b}
Gas-fired or oil-fired furnace < 225,000 Btu/h	—	DOE 10 CFR Part 430, Subpart B, Appendix	AFUE 78% ^b , Et 80% ^c
Gas-fired or oil-fired steam and hot-water boilers < 300,000 Btu/h	—	DOE 10 CFR Part 430, Subpart B, Appendix	AFUE 80% ^{b,d}
Air-cooled air conditioners and heat pumps cooling mode < 65,000 Btu/h cooling capacity, single phase	Split systems	ARI 210/240	13.0 SEER ^b
	Through-the-wall split systems ^g		10.9 SEER ^b
	Through-the-wall single package ^g		10.6 SEER ^b

For SI: 1 Btu/h = 0.2931 W.

- a. For multicapacity equipment, the minimum performance shall apply to each capacity step provided. Multicapacity refers to manufacturer-published ratings for more than one capacity mode allowed by the product's controls.
- b. This is used to be consistent with the National Appliance Energy Conservation Act (NAECA) of 1987 (Public Law 100-12), as amended.
- c. These requirements apply to combination units not covered by NAECA (three-phase power or cooling capacity 65,000 Btu/h).
- d. Except for gas-fired steam boilers for which the minimum AFUE shall be 75%.
- e. Seasonal rating.
- f. Heat pumps manufactured before January 23, 2006 may have an HSPF of 6.8 for split systems and 6.7 for single-package units, and air-conditioners manufactured before January 23, 2006 may have a SEER of 10 for split systems and 9.7 for single-package units. Trade-offs between equipment and other building components are not allowed for equipment that does not exceed the minimums in this table.
- g. These requirements apply to through-the-wall products with cooling capacities less than or equal to 30,000 Btu/h manufactured prior to January 23, 2010.

6106.4.3.1.2 Infiltration. Infiltration for heating and cooling design loads for one-family through four-family dwellings shall be calculated using the methods identified in 780 CMR 6106.4.3.1. For all other buildings covered by 780 CMR 61.00, infiltration shall be calculated using the procedures in 780 CMR 25.00 of the *ASHRAE Handbook of Fundamentals*.

6106.4.3.2 Temperature and Humidity Controls. Temperature and humidity controls shall be provided in accordance with 780 CMR 6106.4.3.2.1 through 6106.4.3.2.4.

6106.4.3.2.1 System Controls. Each dwelling unit shall be considered a zone, and shall be provided with thermostatic controls responding to temperature within the zone. Each zone shall include at least one temperature control device.

In addition, a readily accessible manual or automatic means shall be provided to partially restrict or shut off the heating and/or cooling input to each zone or floor. For spaces other than living units, at least one thermostat for regulation of space temperature shall be provided for:

1. Each separate system.
2. Each separate zone as defined in 780 CMR 52.00. As a minimum, each floor of a building shall be considered as a separate zone. A readily accessible manual or automatic means shall be provided to partially restrict or shut off the heating and/or cooling input to each floor.

6106.4.3.2.2 Thermostatic Control Capabilities. Where used to control comfort heating, thermostatic controls shall be capable of being set locally or remotely by adjustment or selection of sensors down to 55°F (13°C) or lower.

Where used to control comfort cooling, thermostatic controls shall be capable of being set locally or remotely by adjustment or selection of sensors up to 85°F (29°C) or higher.

Where used to control both comfort heating and cooling, thermostatic controls shall be capable of providing a temperature range or deadband of at least 5°F (3°C) within which the supply of heating and cooling energy is shut off or reduced to a minimum.

Exceptions:

1. Special occupancy or special usage conditions approved by the building official.
2. Thermostats that require manual changeover between heating and cooling modes.

6106.4.3.2.3 Heat Pump Auxiliary Heat. Heat pumps having supplementary electric resistance heaters shall have controls that prevent heater operation when the heating load is capable of being met by the heat pump. Supplemental heater operation is not allowed except for a maximum of 15 minutes during outdoor coil defrost cycles.

6106.4.3.2.4 Humidistat. Humidistats used for comfort purposes shall be capable of being set to prevent the use of fossil fuel or electricity to reduce relative humidity below 60% or increase relative humidity above 30%.

6106.4.4 Distribution System, Construction and Insulation. Distribution systems shall be constructed and insulated in accordance with 780 CMR 6106.4.4.1 through 6106.4.4.6.

6106.4.4.1 Piping Insulation. All HVAC system piping shall be thermally insulated in accordance with 780 CMR Table 6106.4.4.1.

Exceptions:

1. Factory-installed piping within HVAC equipment tested and rated in accordance with 780 CMR 6106.4.2.
2. Piping that conveys fluids which have a design operating temperature range between 55°F and 105°F (13°C and 41°C).
3. Piping that conveys fluids which have not been heated or cooled through the use of fossil fuels or electricity.

6106.4.4.2 Other Insulation Thicknesses. Insulation thicknesses in 780 CMR Table 6106.4.4.1 are based on insulation having thermal resistivity in the range of 4.0 to 4.6 h • ft.² • °F/Btu/inch (0.704 to 0.810 m²K/W per 25mm) of thickness on a flat surface at a mean temperature of 75°F (24°C).

Minimum insulation thickness shall be increased for materials having values less than 4.0, or shall be permitted to be reduced for materials having thermal resistivity values greater than 4.6 in accordance with 780 CMR Equation 6106.4.4.2(1).

780CMR EQUATION 6106.4.4.2(1)

$$\frac{4.6 \times \text{Table 6106.4.4.1 Thickness}}{\text{Actual Resistivity}} = \text{New Minimum Thickness}$$

For materials with thermal resistivity values less than 4.0, the minimum insulation thickness shall be permitted to be increased in accordance with 780 CMR Equation 6106.4.4.2(2).

780 CMR EQUATION 6106.4.4.2(2)

$$\frac{4.0 \times \text{Table 6106.4.4.1 Thickness}}{\text{Actual Resistivity}} = \text{New Minimum Thickness}$$

780 CMR TABLE 6106.4.4.1
MINIMUM PIPING INSULATION (thickness in inches)

MINIMUM FIRING INSULATION (thickness in inches)							
PIPING SYSTEM TYPES	FLUID TEMPERATURE RANGE, °F	PIPE SIZES ^a					
		Runouts up to 2" ^b	1" and less	1.25" to 2"	2.5" to 4"	5" to 6"	8" and larger
Heating Systems (Steam and Hot Water)							
Low pressure/temperature	201 - 250	1	1 1/2	1 1/2	2	2	2
Low temperature	120 - 200	1/2	1	1	1 1/2	1 1/2	1 1/2

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, °C = [(°F)-32]/1.8.

- a. For piping exposed to outdoor air, increase insulation thickness by 0.5 inch.
 b. Runouts not exceeding 12 feet in length to individual terminal units.

6106.4.4.3 Duct and Plenum Insulation. All supply and return-air ducts and plenums installed as part of an HVAC air-distribution system shall be thermally insulated in accordance with 780 CMR Table 6106.4.4.3.

Exceptions:

1. Factory-installed plenums, casings or ductwork furnished as a part of the HVAC equipment tested and rated in accordance with 780 CMR 6106.4.2.
2. Ducts within the conditioned space that they serve.
3. R-6 duct insulation (minimum) shall be allowed throughout the entire duct distribution system when the equipment being installed meets or exceeds SEER-14 for central air conditioning equipment and AFUE furnace efficiencies of 83%, (oil), or 90%, (gas). Where two appliances are used within the same distribution system, at least one appliance must meet these requirements.

6106.4.4.4 Duct Construction. Ductwork shall be constructed and erected in accordance with the International Mechanical Code.

6106.4.4.4.1 Duct Systems. All accessible longitudinal and transverse joints, seams and connections of low-pressure supply and return ducts shall be securely fastened and sealed with welds, gaskets, mastics (adhesives) or mastic-plus embedded-fabric systems.

Exception: Continuously welded and locking-type longitudinal joints and seams.

780 CMR TABLE 6106.4.4.3
MINIMUM DUCT INSULATION^a

INSULATION R-VALUE (h • ft ² • °F)/Btu ^d			
Ducts in unconditioned attics, or outside of building	Ducts in unconditioned basements, crawl spaces, garages, and other unconditioned spaces ^c		
Supply	Return	Supply	Return ^b
8	4	8	2

For SI: °C = [(°F)-32]/1.8, 1 (h • ft² • °F)/Btu = 0.176(m² • K)/W; 1 foot = 304.5 mm.

- a. Insulation R-values shown are for the insulation as installed and do not include film resistance. The

required minimum R-values do not consider water vapor transmission and condensation. Where control of condensation is required, additional insulation, vapor retarders or both shall be provided to limit vapor transmission and condensation. For ducts that are designed to convey both heated and cooled air, duct insulation shall be as required by the most restrictive condition. Where exterior walls are used as plenums, wall insulation shall be as required for envelope insulation but shall not be less than R-8.

- b. Insulation on return ducts in basements is not required.
 c. Unconditioned spaces include framed cavities in those floor, wall and ceiling assemblies which (1) separate conditioned space from unconditioned space or outside air, and (2) are uninsulated on the side facing away from the condition space.
 d. Insulation resistance measured on a horizontal plane in accordance with ASTM C 518, at a mean temperature of 75°F.

6106.4.4.4.2 Sealing Required. Tapes and mastics used with rigid fibrous glass ducts shall be listed and labeled in accordance with UL 181A. Tapes and mastics used with flexible air ducts shall be listed and labeled in accordance with UL 181B. "Duct tape" is not permitted as a sealant on any ducts.

6106.4.4.5 Mechanical Ventilation. Each mechanical ventilation system (supply or exhaust, or both) shall be equipped with a readily accessible switch or other means for shutoff, or volume reduction and shutoff, when ventilation is not required. Automatic or gravity dampers that close when the system is not operating shall be provided for outdoor air intakes and exhausts.

6106.4.4.6 Balancing. The HVAC system design shall provide means for balancing air and water systems. Balancing mechanisms shall include, but not be limited to, dampers, temperature and pressure test connections, and balancing valves.

6106.5 Service Water Heating.

6106.5.1 Scope. The purpose of 780 CMR 6106.5 is to provide criteria for design, equipment selection and system construction that will produce energy savings when applied to heated water for other than space conditioning, including

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generation, distribution, controls, storage, heat loss and vapor transmission.

6106.5.2 Water Supplies. Water supplies to ice-making machines, refrigerators and toilets shall be taken from a cold-water line of the water distribution system.**6106.5.3 Water Heaters, Storage Tanks and Boilers.** Water heaters, storage tanks and boilers shall meet the performance criteria set forth in 780 CMR 6106.5.3.1 and 6106.5.3.2.

6106.5.3.1 Performance Efficiency. Water heaters and hot water storage tanks shall meet the minimum performance of water-heating equipment specified in 780 CMR Table 6106.5.3.1. Where multiple criteria are listed, all criteria shall be met.

Exception: Storage water heaters and hot water storage tanks having more than 140 gallons (530 L) of storage capacity need not meet the standby loss (SL) or heat loss (HL) requirements of 780 CMR Table 6106.5.2 if the tank surface area is thermally insulated to R-12.5 and if a standing pilot light is not used.

6106.5.3.2 Combination Service Water-heating/Space-heating boilers. Service water-heating equipment shall not be dependent on year-round operation of space-heating boilers; that is, boilers that have as another function winter space heating.

Exceptions:

1. Systems with service/space-heating boilers having a standby loss (Btu/h) (W) less than:

780 CMR EQUATION 6106.5.3.2

$$(13.3 \text{ pmd} + 400)/n$$

determined by the fixture count method where:

pmd = Probable maximum demand in gallons/hour as determined in accordance with Chapter 37 of the ASHRAE HVAC Systems and Applications Handbook.

n = Fraction of year when outdoor daily mean temperature exceeds 64.9°F (18°C).

The standby loss is to be determined for a test period of 24-hour duration while maintaining a boiler water temperature of 90°F (32°C) above an ambient of 60 to 90°F (16 to 32°C) and a five foot (1524 mm) stack on appliance.

2. For systems where the use of a single heating unit will lead to energy savings, such unit shall be utilized.

6106.5.4 Swimming Pools. Swimming pools shall be provided with energy-conserving measures in accordance with 780 CMR 6106.5.4.1 through 6106.5.4.3.

6106.5.4.1 On-off Switch. All pool heaters shall be equipped with an ON-OFF switch mounted for easy access to allow shutting off the operation of the heater without adjusting the thermostat setting and to allow restarting without relighting the pilot light.

6106.5.4.2 Pool Covers. Heated swimming pools shall be equipped with a pool cover.

6106.5.4.3 Time Clocks. Time clocks shall be installed so that the pump can be set to run in the off-peak electric demand period and can be set for the minimum time necessary to maintain the water in a clear and sanitary condition in keeping with applicable health standards.

6106.5.5 Pump Operation. Circulating hot water systems shall be arranged so that the circulation pump(s) can be conveniently turned off, automatically or manually, when the hot water system is not in operation.

780 CMR TABLE 6106.5.3.1
MINIMUM PERFORMANCE OF WATER HEATING EQUIPMENT

CATEGORY	TYPE	FUEL	INPUT RATING	V_T^a (gallons)	INPUT TO V_T RATIO (Btu/h/gal)	TEST METHOD	ENERGY FACTOR ^b	THERMAL EFFICIENCY E_t (percent)	STANDBY LOSS (percent/hour) ^c
NAECA- covered water-heating equipment ^d	All	Electric	= 12kW	All ^e	—	Note f	= 0.93-0.00132 V^*	—	—
	Storage	Gas	= 75,000 Btu/h	All ^e	—	Note f	= 0.62-0.0019 V^*	—	—
	Instantaneous	Gas	= 200,000Btu/he	All	—	Note f	= 0.62-0.0019 V^*	—	—
	Storage	Oil	= 105,000 Btu/h	All	—	Note f	= 0.59-0.0019 V^*	—	—
	Instantaneous	Oil	= 210,000 Btu/h	All	—	Note f	= 0.59-0.0019 V^*	—	—
	Pool heater	Gas/oil	All	All	—	Note g	—	= 78%	—
Other water-heating equipment ^d	Storage	Electric	All	All	—	Note h	—	—	= 0.30 + 27/ V_T^*
	Storage/ instantaneous	Gas/oil	= 155,000 Btu/h	All	< 4,000	Note h	—	= 78%	= 1.3 + 614/ V_T^*
			> 155,000 Btu/h	All	< 4,000	Note h	—	= 78%	= 1.3 + 95/ V_T^*
				< 10 = 10	= 4,000 = 4,000	Note h	—	=80% =77%	= 2.3 + 67/ V_T^*
Unfired storage tanks	—	—	—	All	—	—	—	—	= 6.5 Btu/h/ft ² ^{21*}

For SI: 1 Btu/ft² = 3.155 W/m², 1 Btu/h = 0.2931 W, 1 gallon = 3.785 L, °C = [(°F)-32]/1.8.

- V_T is the storage volume in gallons as measured during the standby loss test. For the purpose of estimating the standby loss requirement using the rated volume shown on the rating plate, V_T should be no less than 0.95V for gas and oil water heaters and no less than 0.90V for electric water heaters.
- V is rated storage volume in gallons as specified by the manufacturer.
- Consistent with National Appliance Energy Conservation Act (NAECA) of 1987.
- All except those water heaters covered by NAECA.
- DOE CFR 10; Part 430, Subpart B, Appendix E applies to electric and gas storage water heaters with rated volumes 20 gallons and gas instantaneous water heaters with input ratings of 50,000 to 200,000 Btu/h.
- DOE CFR 10; Part 430, Subpart B, Appendix E.
- ANSI Z21.56.
- ANSI Z21.10.3. When testing an electric storage water heater for standby loss using the test procedure of Section 2.9 of ANSI Z21.10.3, the electrical supply voltage shall be maintained within ±1% of the center of the voltage range specified on the water heater nameplate. Also, when needed for calculations, the thermal efficiency (E_t) shall be 98%. When testing an oil water heater using the test procedures of Sections 2.8 and 2.9 of ANSI Z21.10.3, the following modifications will be made: A vertical length of the flue pipe shall be connected to the flue gas outlet of sufficient height to establish the minimum draft specified in the manufacturer's installation instructions. All measurements of oil consumption will be taken by instruments with an accuracy of ± 1% or better. The burner shall be adjusted to achieve an hourly Btu input rate within ± 2% of the manufacturer's specified input rate with the CO₂ reading as specified by the manufacturer with smoke no greater than 1 and the fuel pump pressure within ± 1% of the manufacturer's specification.
- Heat loss of tank surface area (Btu/h • ft²) based on 80°F water-air temperature difference.
- * Minimum efficiencies marked with an asterisk are established by preemptive federal law and are printed for the convenience of the user.

6106.5.6 Pipe Insulation. For recirculating systems, piping heat loss shall be limited to a maximum of 17.5 Btu/h per linear foot (16.8 W/m) of pipe in accordance with 780 CMR Table 6106.5.6, which is based on a design external temperature no lower than 65°F (18°C). Other design temperatures must be calculated.

Exception: Piping insulation is not required when the heat loss of the piping, without insulation, does not increase the annual energy requirements of the building.

780 CMR TABLE 6106.5.6
MINIMUM PIPE INSULATION (thickness in inches)

SERVICE WATER HEATING TEMPERATURES (°F)	PIPE SIZES ^a			
	Noncirculating runouts	Circulating mains and runouts		
		Up to 1"	Up to 1.25"	1.5 to 2"
170-180	0.5	1	1.5	2
140-169	0.5	0.5	1	1.5
100-139	0.5	0.5	0.5	1

For SI: 1 inch = 25.4 mm, °C = [(°F)-32]/1.8,
 1 Btu/h/inch • ft² • °F = 0.144 W/(m • K).

- Nominal iron pipe size and insulation thickness.
 Conductivity, $k \approx 0.27$

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6106.5.7 Conservation of Hot Water. Hot water shall be conserved in accordance with 780 CMR 6106.5.7.1.

6106.5.7.1 Showers. Shower heads shall have a maximum flow rate of 2.5 gallons per minute (gpm) (0.158 L/s) at a pressure of 80 pounds per square inch (psi) (551 kPa) when tested in accordance with ASME A612.18.1.

6106.5.8 Heat Traps. Reserved.

6106.5.9 Automatic Controls. Service water-heating systems shall be equipped with automatic temperature controls capable of adjustment from the lowest to the highest acceptable temperature settings for the intended use. Temperature setting range shall be in accordance with Table 2 in Chapter 37 of *ASHRAE HVAC Systems and Applications Handbook*, as listed in 780 CMR 100.00.

6106.5.10 Shutdown. A separate switch or valve shall be provided to permit turning off the energy supplied to service water-heating systems.

6106.6 Electrical Power and Lighting.

6106.6.1 Electrical Energy Consumption. In multi-family dwellings, provisions shall be made to determine the electrical energy consumed by each tenant by separately metering individual dwelling units.

Exception: Motels, hotels, college dormitories and other transient facilities.

**780 CMR 6107 ENVELOPE DESIGN
COMPLIANCE**

6107.1 General. Buildings constructed to 780 CMR 6107 shall also meet the applicable requirements of 780 CMR 6106.

6107.2 Building Design by Prescriptive Package.

6107.2.1 Applicability. This prescriptive package approach is intended for one- and two-family detached buildings of wood frame or mass wall construction (concrete, masonry, log). Metal frame buildings are excluded. This approach may be used for all climate zones,

regardless of glazing percentage.

6107.2.2 Envelope Requirements. Component values shall be taken from 780 CMR Table 6107.1.

6107.3 Building Design by Approved Software.

6107.3.1 Applicability. This software approach may be utilized for all low-rise residential buildings covered by 780 CMR 51.00 through 99.00.

6107.3.2 Envelope Requirements. To determine compliance with the various wall, roof and floor assemblies, and heating and/or cooling system efficiencies, a REScheck Version 4.1.2 (October 2007) or later variant Software analysis must be completed, and the "Your UA" value must be less than or equal to the "Max. UA" value calculated by the software.

6107.3.3 Submittal. The "Compliance Report" and "Inspection Checklist" of the REScheck Program shall be submitted to the local building department before a permit is issued. A window schedule including the areas (based on rough opening), and the number of windows, skylights and other glazed fenestration, shall also be submitted.

**780 CMR 6108 BUILDING DESIGN BY
SYSTEMS ANALYSIS AND DESIGN OF
BUILDINGS UTILIZING RENEWABLE
ENERGY SOURCES**

6108.1 General. 780 CMR 6108 establishes design criteria in terms of total energy use by a residential building, including all of its systems.

6108.2 Energy Analysis. Conform to the requirements of the applicable Sections of 780 CMR Chapter 13 of the *Sixth Edition, Massachusetts State Building Code* and with recognition of the amended efficiency requirements of NAECA, if applicable.

**780 CMR 6109 BUILDING DESIGN BY
HOME ENERGY RATING**

Reserved

**780 CMR TABLE 6107.1
PRESCRIPTIVE ENVELOPE COMPONENT CRITERIA FOR NEW ONE- AND
TWO-FAMILY BUILDINGS"**

MAXIMUM Fenestration U-factor	MINIMUM							
	Ceiling or Exposed Floors R-Value	Wall R-Value	Floor R-Value	Basement Wall R-Value	Slab Perimeter R-Value and Depth	AFUE	HSPF	SEER
0.35	R-38	R-19	R-19	R-10	R-10, 4 ft	National Appliance Energy Conservation Act (NAECA) of 1987 as amended, minimums or greater as applicable		

For SI: 1 foot = 304.8 mm.

a. R-values are for insulation materials only, not for overall component.

780 CMR 62.00

MECHANICAL ADMINISTRATION

780 CMR 6201 GENERAL

6201.1 Scope. The provisions of 780 CMR 62.00 through 74.00 shall regulate the design, installation, maintenance, alteration and inspection of mechanical systems that are permanently installed and utilized to provide control of environmental conditions within buildings. These chapters shall also regulate those mechanical systems, system components, equipment and appliances specifically addressed in 780 CMR 51.00 through 99.00.

Exception: Where the design, installation, maintenance, alteration and/or inspection of mechanical systems that are permanently installed and utilized to provide control of environmental conditions within buildings is controlled by 248 CMR, 522 CMR, 527 CMR or 528 CMR, the requirements of such Massachusetts Specialized Codes shall govern.

248 CMR — “Fuel Gas and Plumbing Code”

522 CMR — “Board of Boiler Rules”

527 CMR — “Fire Code”

527 CMR 12.00 — “Massachusetts Electrical Code”

528 CMR — “Bureau of Pipefitters and Refrigeration Technicians”.

6201.2 Application. In addition to the general administration requirements of 780 CMR 51.00, the supplemental administrative provisions of 780 CMR 62.00 shall also apply to the mechanical requirements of 780 CMR 63.00 through 74.00.

Note: This supplementing of the administrative provisions is necessary, in part, as the regulatory requirements of other state agencies legally impact the design, installation and/or maintenance of fossil fuel-fired appliances; i.e., 248 CMR for gas-fired appliance, 527 CMR for oil-fired appliances and 527 CMR 12 as the Massachusetts Electrical Code and/or other Massachusetts Specialized Codes, as applicable.

6201.3 Conformity. *Conformity to the applicable Code of Massachusetts Regulations (248 CMR, 527 CMR or other Massachusetts Specialized Codes) or otherwise to the applicable provisions and reference standards of 780 CMR 51.00 through 99.00 is required.*

780 CMR 6202 EXISTING MECHANICAL SYSTEMS

6202.1 Additions, Alterations or Repairs. *Additions, alterations, repairs or replacement shall be made to existing mechanical systems in accordance with the requirements of the applicable CMR (note that 248 CMR, 527 CMR and other*

Massachusetts Specialized Codes are enforced by other than building officials) except that in the absence of other CMR regulatory control, in an existing one- or two-family detached home, any new mechanical system shall conform to 780 CMR 51.00 through 99.00 for new construction to the fullest extent practical. However, individual components of an existing mechanical system may be repaired or replaced without requiring that system to comply with 780 CMR 51.00 through 99.00 for new construction, provided such component repair or replacement shall not cause an existing system to become unsafe, unsanitary or overloaded. Minor additions, alterations or repairs to existing mechanical systems shall meet the provisions for new construction, unless such work is done in the same manner and arrangement as was in the existing system; is not hazardous, and is approved.

6202.2 Existing installations. Except as otherwise provided for in 780 CMR 51.00 through 99.00, a provision in 780 CMR 51.00 through 99.00 shall not require the removal, alteration or abandonment of, nor prevent the continued utilization and maintenance of, an existing mechanical system lawfully in existence at the time of the adoption of 780 CMR 51.00 through 99.00.

Exception: Where the removal, alteration or abandonment of mechanical systems that are permanently installed and utilized to provide control of environmental conditions within buildings are controlled by 248 CMR, 527 CMR or other Massachusetts Specialized Codes, such Specialized Codes' requirements, as applicable, shall govern.

6202.3 Maintenance. Mechanical systems, both existing and new, and parts thereof shall be maintained in proper operating condition in accordance with the original design and in a safe and sanitary condition. Devices or safeguards that are required by 780 CMR 51.00 through 99.00 or the Massachusetts Specialized Codes shall be maintained in compliance with the code edition under which installed. The owner or the owner's designated agent shall be responsible for maintenance of the mechanical systems. To determine compliance with this provision, the building official shall have the authority to require a mechanical system, falling under the jurisdiction of 780 CMR 51.00 through 99.00 to be reinspected for compliance with requirements of 780 CMR 51.00 through 99.00 and where mechanical systems otherwise fall under the jurisdiction of the Massachusetts Specialized Codes, the building

*official may request, of other applicable regulatory
authorities, reinspection of such Massachusetts
Specialized Codes mechanical systems.*

GENERAL MECHANICAL SYSTEMS REQUIREMENTS

780 CMR 6301 GENERAL

6301.1 Scope. The provisions of 780 CMR 63.00 shall govern the installation of mechanical systems not specifically covered in other chapters applicable to mechanical systems. Installations of mechanical appliances, equipment and systems not addressed by 780 CMR 51.00 through 99.00 shall comply with the applicable provisions of the *International Mechanical Code as applicable*.

Note: Where legal jurisdiction for the listing, design, installation, maintenance, alteration and/or inspection of mechanical systems is controlled by one or more of the Massachusetts Specialized Codes, the requirements of such Massachusetts Specialized Code(s) shall apply and the requirements of 780 CMR 51.00 through 99.00 shall not apply (refer to 780 CMR 100.00: Referenced Standards for a list of the Massachusetts Specialized Codes).

6301.1.1 Flood-resistant Installation. In areas prone to flooding as established by *FEMA Flood Insurance Rate Maps or accepted equivalent (see 780 CMR 5323 as applicable)*, mechanical appliances, equipment and systems shall be located or installed in accordance with 780 CMR 5323.1.5.

780 CMR 6302 APPROVAL

6302.1 General. All appliances shall be listed and bear the label of an approved agency unless otherwise approved in accordance with 780 CMR 5109.4.

Note: Where the subject appliance is controlled by the Specialized Codes and not the State Building Code criteria of the Massachusetts Specialized Codes govern (see 780 CMR 100.00: Referenced Standards for a list of the Massachusetts Specialized Codes).

780 CMR 6303 LABELING OF APPLIANCES

6303.1 Label Information. *For labeling requirements for solid fuel-burning appliances refer to 780 CMR 63.00. For fossil fuel-burning appliances refer to the labeling requirements of the applicable Massachusetts Specialized Code (248 CMR or 527 CMR). For electrical appliances refer to 527 CMR 12.*

Note that labeling requirements shall also include:

Absorption units. Hourly rating in Btu/h (W), minimum hourly rating for units having step or automatic modulating controls, type of fuel,

type of refrigerant, cooling capacity in Btu/h (W), and required clearances.

780 CMR 6304 TYPE OF FUEL

6304.1 Fuel Types. Fuel-fired appliances shall be designed for use with the type of fuel to which they will be connected and the altitude at which they are installed. *Refer to the Massachusetts Specialized Codes (248 CMR and 527 CMR) for gas and oil-fired appliance requirements, respectively.* Appliances that comprise parts of the building mechanical systems shall not be converted for the usage of a different fuel, except where approved and converted in accordance with the manufacturer's instructions. The fuel input rate shall not be increased or decreased beyond the limit rating for the altitude at which the appliance is installed.

780 CMR 6305 APPLIANCE ACCESS

6305.1 Appliance Access for Inspection Service, Repair and Replacement. Appliances shall be accessible for inspection, service, repair and replacement without removing permanent construction. *Refer to the Massachusetts Specialized Codes, 248 CMR and 527 CMR, for appliance access requirements for gas and oil-fired appliances, but otherwise the appliance manufacturer's access requirements and those set forth below shall apply.*

Access requirements:

30 inches (762 mm) of working space shall be provided in front of the control side to service an appliance. Room heaters shall be permitted to be installed with at least an 18-inch (457 mm) working space. A platform shall not be required for room heaters.

6305.1.1 Central Furnaces. Central furnaces within compartments or alcoves shall have a minimum working space clearance of three inches (76 mm) along the sides, back and top with a total width of the enclosing space being at least 12 inches (305 mm) wider than the furnace. Furnaces having a firebox open to the atmosphere shall have at least a six-inch (152 mm) working space along the front combustion chamber side. Combustion air openings at the rear or side of the compartment shall comply with the requirements of 780 CMR 67.00.

Exception: 780 CMR 6305.1 shall not apply to replacement appliances installed in existing compartments and alcoves where the working space clearances are in accordance with the equipment or appliance manufacturer's

installation instructions.

6305.1.2 Appliances in Rooms. Appliances installed in a compartment, alcove, basement or similar space shall be accessed by an opening or door and an unobstructed passageway measuring not less than 24 inches (610 mm) wide and large enough to allow removal of the largest appliance in the space, provided that a level service space of not less than 30 inches (762 mm) deep and the height of the appliance, but not less than 30 inches (762 mm), is present at the front or service side of the appliance with the door open.

6305.1.3 Appliances in Attics. Attics containing appliances requiring access shall be provided with an opening and a clear and unobstructed passageway large enough to allow removal of the largest appliance, but not less than 30 inches (762 mm) high and 22 inches (559 mm) wide and not more than 20 feet (6096 mm) in length when measured along the centerline of the passageway from the opening to the appliance. The passageway shall have continuous solid flooring in accordance with 780 CMR 55 not less than 24 inches (610 mm) wide. A level service space at least 30 inches (762 mm) deep and 30 inches (762 mm) wide shall be present along all sides of the appliance where access is required. The clear access opening dimensions shall be a minimum of 20 inches by 30 inches (508 mm by 762 mm), where such dimensions are large enough to allow removal of the largest appliance.

Exception: The passageway and level service space are not required where the appliance is capable of being serviced and removed through the required opening.

6305.1.3.1 Electrical Requirements. *Refer to manufacturer's requirements and requirements of 527 CMR 12.*

6305.1.4 Appliances under Floors. Under-floor spaces containing appliances requiring access shall be provided with an unobstructed passageway large enough to remove the largest appliance, but not less than 30 inches (762 mm) high and 22 inches (559 mm) wide, nor more than 20 feet (6096 mm) in length when measured along the centerline of the passageway from the opening to the appliance. A level service space at least 30 inches (762 mm) deep and 30 inches (762 mm) wide shall be present at the front or service side of the appliance. If the depth of the passageway or the service space exceeds 12 inches (305 mm) below the adjoining grade, the walls of the passageway shall be lined with concrete or masonry extending four inches (102 mm) above the adjoining grade in accordance with 780 CMR 54.00. The rough-framed access opening dimensions shall be a minimum of 22 inches by 30 inches (559 mm by 762 mm), where the dimensions are large enough to remove the

largest appliance.

Exception: The passageway is not required where the level service space is present when the access is open, and the appliance is capable of being serviced and removed through the required opening.

6305.1.4.1 Ground Clearance. Appliances supported from the ground shall be level and firmly supported on a concrete slab or other approved material extending above the adjoining ground. Appliances suspended from the floor shall have a clearance of not less than six inches (152 mm) from the ground.

6305.1.4.2 Excavations. Excavations for appliance installations shall extend to a depth of six inches (152 mm) below the appliance and 12 inches (305 mm) on all sides, except that the control side shall have a clearance of 30 inches (762 mm).

6305.1.4.3 Electrical Requirements. *Refer to manufacturer's requirements and requirements of 527 CMR.*

780 CMR 6306 CLEARANCES FROM COMBUSTIBLE CONSTRUCTION

6306.1 Appliance Clearance. Appliances shall be installed with the clearances from unprotected combustible materials as indicated on the appliance label and in the manufacturer's installation instructions.

6306.2 Clearance Reduction. *Reduction of clearances of fossil fuel-burning appliances shall be in accordance with the appliance manufacturer's instructions and 248 CMR or 527 CMR as applicable and otherwise conform to the requirements of 780 CMR Table 6306.2. Construction documents reflecting manufacturer's reduced clearance requirements and/or applicable requirements from 248 CMR and 527 CMR (gas or oil-fired appliances, respectively) demonstrating the validity of such reduced clearances are required as part of the building permit application. In all cases where reduced clearance is achieved with ventilated air spaces between the appliance and the combustible surfaces of the building, such protection with ventilated air space shall conform to the following requirements (unless it can be demonstrated by manufacturer's requirements and/or Massachusetts Specialized Code allowances that such reduced clearances to combustibles are acceptable) (also see 780 CMR Figure 6306.2):*

1. Not less than one-inch (25.4 mm) air space shall be provided between the protection and combustible wall surface.
2. Air circulation shall be provided by having edges of the wall protection open at least one inch (25.4 mm).
3. If the wall protection is mounted on a single

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flat wall away from corners, air circulation shall be provided by having the bottom and top edges, or the side and top edges open at least one inch (25.4 mm).

4. Wall protection covering two walls in a corner shall be open at the bottom and top edges at least one inch (25.4 mm).

6306.2.1 Solid Fuel Appliances. 780 CMR

Table 6306.2 shall not be used to reduce the clearance required for solid fuel appliances listed for installation with minimum clearances of 12 inches (305 mm) or less. For appliances listed for installation with minimum clearances greater than 12 inches (305 mm), 780 CMR Table 6306.2 shall not be used to reduce the clearance to less than 12 inches (305 mm).

780 CMR TABLE 6306.2

REDUCTION OF CLEARANCES WITH SPECIFIED FORMS OF PROTECTION^{a,b,c,d,e,f,g,h,i,j,k,l}

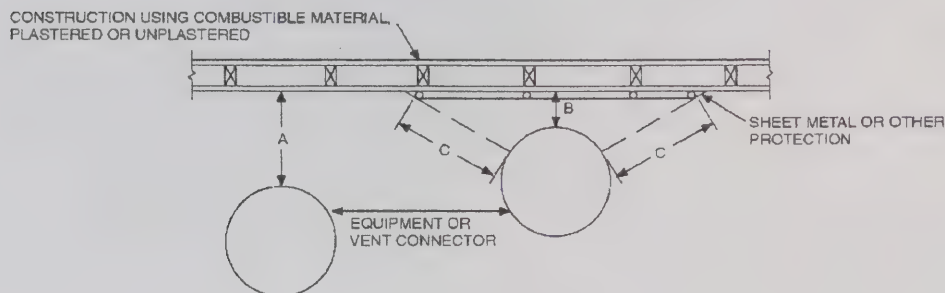
TYPE OF PROTECTION APPLIED TO AND COVERING ALL SURFACES OF COMBUSTIBLE MATERIAL WITHIN THE DISTANCE SPECIFIED AS THE REQUIRED CLEARANCE WITH NO PROTECTION [See Figures 6306.1 and 6306.2]	WHERE THE REQUIRED CLEARANCE WITH NO PROTECTION FROM APPLIANCE, VENT CONNECTOR, OR SINGLE WALL METAL PIPE IS:									
	36 inches		18 inches		12 inches		9 inches		6 inches	
	Allowable clearances with specified protection (Inches) ^b									
	Use column 1 for clearances above an appliance or horizontal connector. Use column 2 for clearances from an appliance, vertical connector and single-wall metal pipe.									
	Above column 1	Sides and rear column 2	Above column 1	Sides and rear column 2	Above column 1	Sides and rear column 2	Above column 1	Sides and rear column 2	Above column 1	Sides and rear column 2
3½-inch thick masonry wall without ventilated air space	—	24	—	12	—	9	—	6	—	5
½-in. insulation board over 1-inch glass fiber or mineral wool batts	24	18	12	9	9	6	6	5	4	3
24 gage sheet metal over one-inch glass fiber or mineral wool batts reinforced with wire on rear face with ventilated air space	18	12	9	6	6	4	5	3	3	3
3½-inch thick masonry wall with ventilated air space	—	12	—	6	—	6	—	6	—	6
24 gage sheet metal with ventilated air space	18	12	9	6	6	4	5	3	3	2
½-inch thick insulation board with ventilated air space	18	12	9	6	6	4	5	3	3	3
24 gage sheet metal with ventilated air space over 24 gage sheet metal with ventilated air space	18	12	9	6	6	4	5	3	3	3
one-inch glass fiber or mineral wool batts sandwiched between two sheets 24 gage sheet metal with ventilated air space.	18	12	9	6	6	4	5	3	3	3

For SI: 1 inch = 25.4 mm, 1 pound per cubic foot = 16.019 kg/m³, °C = [(°F)-32]/1.8, 1 Btu/(n • ft² • °F/in) = 0.001442299 (w/cm² • °C/cm).

- Reduction of clearances from combustible materials shall not interfere with combustion air, draft hood clearance and relief, and accessibility of servicing.
- Clearances shall be measured from the surface of the heat producing appliance or equipment to the outer surface of the combustible material or combustible assembly.
- Spacers and ties shall be of noncombustible material. No spacer or tie shall be used directly opposite appliance or connector.
- Where all clearance reduction systems use a ventilated air space, adequate provision for air circulation shall be provided as described. (See 780 CMR Figures 6306.1 and 6306.2.)
- There shall be at least 1 inch between clearance reduction systems and combustible walls and ceilings for reduction systems using ventilated air space.
- If a wall protector is mounted on a single flat wall away from corners, adequate air circulation shall be permitted to be provided by leaving only the bottom and top edges or only the side and top edges open with at least a 1-inch air gap.
- Mineral wool and glass fiber batts (blanket or board) shall have a minimum density of 8 pounds per cubic foot and a minimum melting point of 1,500°F.
- Insulation material used as part of a clearance reduction system shall have a thermal conductivity of 1.0 Btu inch per square foot per hour °F or less. Insulation board shall be formed of noncombustible material.

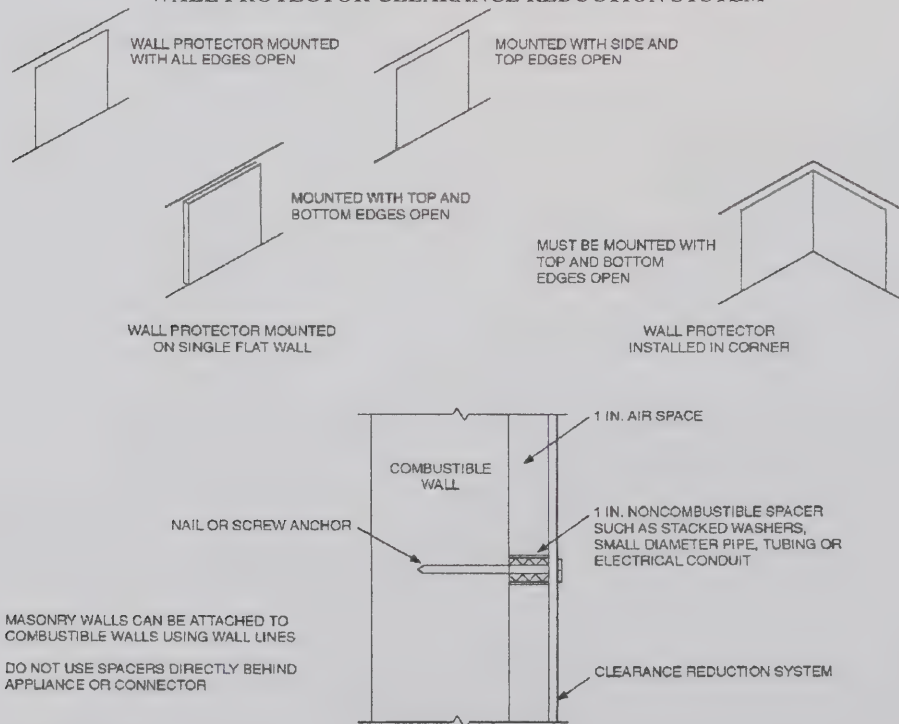
- i. There shall be at least one inch between the appliance and the protector. In no case shall the clearance between the appliance and the combustible surface be reduced below that allowed in 780 CMR Table 6306.2.
- j. All clearances and thicknesses are minimum; larger clearances and thicknesses are acceptable.
- k. Listed single-wall connectors shall be permitted to be installed in accordance with the terms of their listing and the manufacturer's instructions.
- l. *For solid fuel-burning appliances, compliance with 780 CMR 6306.2.1 is also required.*

780 CMR FIGURE 6306.1
REDUCED CLEARANCE DIAGRAM



Note: "A" equals the required clearance with no protection. "B" equals the reduced clearance permitted in accordance with 780 CMR Table 6306.2. The protection applied to the construction using combustible material shall extend far enough in each direction to make "C" equal to "A".

780 CMR FIGURE 6306.2
WALL PROTECTOR CLEARANCE REDUCTION SYSTEM



For SI: 1 inch = 25.4 mm.

780 CMR 6307 APPLIANCE INSTALLATION

6307.1 General. Installation of appliances shall conform to the conditions of their listing and label and the manufacturer's installation instructions. The manufacturer's operating and installation instructions shall remain attached to the appliance.

6307.2 Anchorage of appliances. *Appliances shall be anchored when the appliance manufacturer*

and/or the requirements of the Massachusetts Specialized Codes, or 780 CMR 51.00 through 99.00, as applicable, require that appliances be anchored.

6307.3 Elevation of Ignition Source. Appliances having an ignition source shall be elevated such that the source of ignition is not less than 18 inches (457 mm) above the floor in garages. For the purpose of 780 CMR 6307, rooms or spaces that are not part of

the living space of a dwelling unit and that communicate with a private garage through openings shall be considered to be part of the garage.

6307.3.1 Protection from impact. Appliances located in a garage or carport shall be protected from impact by automobiles.

6307.4 Hydrogen Generating and Refueling Operations. Ventilation shall be required in accordance with 780 CMR 6307.4.1, 6307.4.2 or 6307.4.3 in private garages which contain hydrogen generating appliances or refueling systems. Such spaces shall be used for the storage of not more than three hydrogen-fueled passenger motor vehicles and have a floor area not exceeding 850 square feet (79 m²). The maximum rated output capacity of hydrogen generating appliances shall not exceed 4 SCF of hydrogen for each 250 square feet (23.2 m²) of floor area in such spaces. For the purpose of 780 CMR 6307.4, rooms or spaces that are not part of the living space of a dwelling unit and that communicate directly with a private garage through openings shall be considered to be part of the private garage.

6307.4.1 Natural Ventilation. Indoor locations intended for hydrogen generating or refueling operations shall communicate with the outdoors in accordance with 780 CMR 6307.4.1.1 through 6307.4.1.2. The minimum dimension of air openings shall be not less than three inches (76 mm). Where ducts are used, they shall be of the same cross-sectional area as the free area of the openings to which they connect. In such locations, equipment and appliances having an ignition source shall be located such that the source of ignition is not less than 12 inches (305 mm) below the ceiling.

6307.4.1.1 Two Openings. Two permanent openings, one located entirely within 12 inches (305 mm) of the ceiling of the garage, and one located entirely within 12 inches (305 mm) of the floor of the garage, shall be provided in the same exterior wall. The openings shall communicate directly, or by ducts, with the outdoors. Each opening shall directly communicate with the outdoors horizontally, and have a minimum free area of 1/2 square foot per 1,000 cubic feet (1 m²/610 m³) of garage volume.

6307.4.1.2 Louvers and Grilles. In calculating free area required by 780 CMR 6307.4.1, the required size of openings shall be

based on the net free area of each opening. If the free area through a design of louver or grille is known, it shall be used in calculating the size opening required to provide the free area specified. If the design and free area are not known, it shall be assumed that wood louvers will have a 25% free area and metal louvers and grilles will have a 75% free area. Louvers and grilles shall be fixed in the open position.

6307.4.2 Mechanical Ventilation. Indoor locations intended for hydrogen generating or refueling operations shall be ventilated in accordance with Section 502.16 of the *International Mechanical Code*.

6307.4.3 Specially Engineered Installations. As an alternative to the provisions of 780 CMR 6307.4.1 and 6307.4.2, the necessary supply of air for ventilation and dilution of flammable gases shall be provided by an approved engineered system.

6307.5 Electrical Appliances. Electrical appliances shall be installed in accordance 527 CMR 12 and the manufacturer's requirements.

780 CMR 6308 MECHANICAL SYSTEMS INSTALLATION

6308.1 Drilling and Notching. Wood-framed structural members shall be drilled, notched or altered in accordance with the provisions of 780 CMR 5502.8, 5602.6, 5602.6.1 and 5802.7. Holes in cold-formed, steel-framed, load-bearing members shall only be permitted in accordance with 780 CMR 5505.2, 5603.2 and 5804.2. In accordance with the provisions of 780 CMR 5505.3.5, 5603.3.4 and 5804.3.5, cutting and notching of flanges and lips of cold-formed, steel-framed, load-bearing members shall not be permitted.

6308.2 Protection Against Physical Damage. In concealed locations where piping, other than cast-iron or galvanized steel, is installed through holes or notches in studs, joists, rafters or similar members less than 1.5 inches (38 mm) from the nearest edge of the member, the pipe shall be protected by shield plates. Protective shield plates shall be a minimum of 0.062-inch-thick (1.6mm) steel, shall cover the area of the pipe where the member is notched or bored, and shall extend a minimum of two inches (51 mm) above sole plates and below top plates.

NON-TEXT PAGE

HEATING AND COOLING EQUIPMENT

780 CMR 6401 GENERAL

6401.1 Installation. Heating and cooling equipment and appliances shall be installed in accordance with the manufacturer's installation instructions and the requirements of 780 CMR 51.00 through 99.00 *or the Massachusetts Specialized Code (248 CMR, 522 CMR, 527 CMR and/or 528 CMR), as applicable.*

6401.2 Access. Heating and cooling equipment shall be located with respect to building construction and other equipment to permit maintenance, servicing and replacement. Clearances shall be maintained to permit cleaning of heating and cooling surfaces; replacement of filters, blowers, motors, controls and vent connections; lubrication of moving parts; and adjustments (*refer to the manufacturer's requirements and 780 CMR 51.00 through 99.00 or the Massachusetts Specialized Codes (248 CMR or 527 CMR), as applicable.*)

6401.3 Sizing. Heating and cooling equipment shall be sized based on building loads calculated in accordance with ACCA Manual J or other approved heating and cooling calculation methodologies (*refer to 780 CMR 61.00 for detailed requirements.*)

6401.4 Exterior Installations. Equipment installed outdoors shall be listed and labeled for outdoor installation. Supports and foundations shall prevent excessive vibration, settlement or movement of the equipment. Supports and foundations shall be level and conform to the manufacturer's installation instructions.

6401.5 Flood Hazard. In areas prone to flooding as established by 780 CMR Table 5301.2(1), heating and cooling equipment and appliances shall be located or installed in accordance with 780 CMR 5323.1.5.

780 CMR 6402 CENTRAL FURNACES

6402.1 General. *Gas-fired furnaces shall conform to the requirements of 248 CMR and the efficiency and sizing requirements of 780 CMR 51.00 through 99.00. Oil-fired central furnaces shall conform to requirements of 527 CMR 4.00 and the efficiency and sizing requirements of 780 CMR 51.00 through 99.00. Electric furnaces shall conform to the requirements of 527 CMR 12.00.*

6402.2 Clearances. Clearances shall be provided in accordance with the listing and the manufacturer's installation instructions; *the requirements of 248 CMR or 527 CMR, as applicable, or 780 CMR 51.00 through 99.00 when applicable.*

6402.3 Combustion Air. Combustion air shall be supplied in accordance with 780 CMR 67.00. Combustion air openings shall be unobstructed for a distance of not less than six inches (152 mm) in front of the openings.

780 CMR 6403 HEAT PUMP EQUIPMENT

6403.1 Heat Pumps. The minimum unobstructed total area of the outside and return air ducts or openings to a heat pump shall be not less than six square inches per 1,000 Btu/h (13 208 mm²/kW) output rating or as indicated by the conditions of the listing of the heat pump. Electric heat pumps shall conform to the *requirements of 527 CMR 12.00 or UL 1995, as applicable.*

6403.2 Foundations and Supports. Supports and foundations for the outdoor unit of a heat pump shall be raised at least three inches (76 mm) above the ground to permit free drainage of defrost water, and shall conform to the manufacturer's installation instructions.

780 CMR 6404 REFRIGERATION COOLING EQUIPMENT

6404.1 Compliance. Refrigeration cooling equipment shall comply with 780 CMR 6411.

780 CMR 6405 BASEBOARD CONVECTORS

6405.1 General. Electric baseboard convectors shall be installed in accordance with the manufacturer's installation instructions and 527 CMR 12.00.

780 CMR 6406 RADIANT HEATING SYSTEMS

6406.1 General. Electric radiant heating systems shall be installed in accordance with the manufacturer's installation instructions and 527 CMR 12.00.

6406.2 Clearances. Clearances for radiant heating panels or elements to any wiring, outlet boxes and junction boxes used for installing electrical devices or mounting lighting fixtures shall comply with the *requirement of 527 CMR 12.00 and the manufacturer's requirements.*

6406.3 Installation of Radiant Panels. *Unless controlled by 527 CMR 12.00, radiant panels installed on wood framing shall conform to the manufacturer's installation requirements and the following requirements:*

1. Heating panels shall be installed parallel to

framing members and secured to the surface of framing members or mounted between framing members.

2. Panels shall be nailed or stapled only through the unheated portions provided for this purpose and shall not be fastened at any point closer than ¼ inch (6.4 mm) from an element.

3. Unless listed and labeled for field cutting, heating panels shall be installed as complete units.

6406.4 Installation in Concrete or Masonry. Radiant heating systems installed in concrete or masonry shall conform to the following requirements:

1. Radiant heating systems shall be identified as being suitable for the installation, and shall be secured in place, as specified in the manufacturer's installation instructions.

2. Radiant heating panels or radiant heating panel sets shall not be installed where they bridge expansion joints unless protected from expansion and contraction.

6406.5 Gypsum Panels. Where radiant heating systems are used on gypsum assemblies, operating temperatures shall not exceed 125°F (52°C).

6406.6 Finish Surfaces. Finish materials installed over radiant heating panels or systems shall be installed in accordance with the manufacturer's installation instructions. Surfaces shall be secured so that nails or other fastenings do not pierce the radiant heating elements.

780 CMR 6407 DUCT HEATERS

6407.1 General. Electric duct heaters shall be installed in accordance with the manufacturer's installation instructions and 527 CMR 12.00. Electric furnaces shall be tested in accordance with the requirements of 527 CMR 12.00 or UL 1995, as applicable.

6407.2 Installation. Electric duct heaters shall be installed so that they will not create a fire hazard. Class 1 ducts, duct coverings and linings shall be interrupted at each heater to provide the clearances specified in the manufacturer's installation instructions. Such interruptions are not required for duct heaters listed and labeled for zero clearance to combustible materials. Insulation installed in the immediate area of each heater shall be classified for the maximum temperature produced on the duct surface.

6407.3 Installation with Heat Pumps and Air Conditioners. Duct heaters located within four feet (1219 mm) of a heat pump or air conditioner shall be listed and labeled for such installations. The heat pump or air conditioner shall additionally be listed and labeled for such duct heater installations.

6407.4 Access. Duct heaters, in accordance with manufacturer's requirements and 527 CMR 12.00

shall be accessible for servicing, and clearance shall be maintained to permit adjustment, servicing and replacement of controls and heating elements.

6407.5 Fan Interlock. The fan circuit shall be provided with an interlock to prevent heater operation when the fan is not operating (*also see 780 CMR 61.00*).

780 CMR 6408 VENTED FLOOR FURNACES

6408.1 General. Vented floor furnaces shall conform to the requirements of the *Massachusetts Specialized Codes (248 CMR or 527 CMR)*, as applicable, and be installed in accordance with their listing, the manufacturer's installation instructions and the requirements of 780 CMR 51.00 through 99.00, if applicable.

6408.2 Clearances. Vented floor furnaces shall be installed in accordance with their listing and the manufacturer's installation instructions, any applicable requirements of the *Massachusetts Specialized Codes and the requirements of 780 CMR 51.00 through 99.00* (see 780 CMR 6408.3) if applicable.

6408.3 Location. Location of floor furnaces shall conform to the following requirements:

1. Floor registers of floor furnaces shall be installed not less than six inches (152 mm) from a wall.
2. Wall registers of floor furnaces shall be installed not less than six inches (152 mm) from the adjoining wall at inside corners.
3. The furnace register shall be located not less than 12 inches (305 mm) from doors in any position, draperies or similar combustible objects.
4. The furnace register shall be located at least five feet (1524 mm) below any projecting combustible materials.
5. The floor furnace burner assembly shall not project into an occupied under-floor area.
6. The floor furnace shall not be installed in concrete floor construction built on grade.
7. The floor furnace shall not be installed where a door can swing within 12 inches (305 mm) of the grill opening.

6408.4 Access. An opening in the foundation not less than 18 inches by 24 inches (457 mm by 610 mm), or a trap door not less than 22 inches by 30 inches (559 mm by 762 mm) shall be provided for access to a floor furnace. The opening and passageway shall be large enough to allow replacement of any part of the equipment.

6408.5 Installation. Floor furnace installations shall conform to the following requirements:

1. Thermostats controlling floor furnaces shall be located in the room in which the register of the floor furnace is located.
2. Floor furnaces shall be supported independently of the furnace floor register.

3. Floor furnaces shall be installed not closer than six inches (152 mm) to the ground. Clearance may be reduced to two inches (51 mm), provided that the lower six inches (152 mm) of the furnace is sealed to prevent water entry.

4. Where excavation is required for a floor furnace installation, the excavation shall extend 30 inches (762 mm) beyond the control side of the floor furnace and 12 inches (305 mm) beyond the remaining sides. Excavations shall slope outward from the perimeter of the base of the excavation to the surrounding grade at an angle not exceeding 45 degrees (0.39 rad) from horizontal.

5. Floor furnaces shall not be supported from the ground.

780 CMR 6409 VENTED WALL FURNACES

6409.1 General. Vented wall furnaces shall conform to the requirements of the *Massachusetts Specialized Codes (248 CMR or 527 CMR)*, as applicable, and be installed in accordance with their listing, the manufacturer's installation instructions and the requirements of 780 CMR 51.00 through 99.00, if applicable (see 780 CMR 6409.2).

6409.2 Location. The location of vented wall furnaces shall conform to the following requirements:

1. Vented wall furnaces shall be located so as not to cause a fire hazard to walls, floors, combustible furnishings or doors. Vented wall furnaces installed between bathrooms and adjoining rooms shall not circulate air from bathrooms to other parts of the building.

2. Vented wall furnaces shall not be located where a door can swing within 12 inches (305 mm) of the furnace air inlet or outlet measured at right angles to the opening. Doorstops or door closers shall not be installed to obtain this clearance.

6409.3 Installation. Vented wall furnace installations shall conform to the following requirements:

1. Required wall thicknesses shall be in accordance with the manufacturer's installation instructions.

2. Ducts shall not be attached to a wall furnace. Casing extensions or boots shall only be installed when listed as part of a listed and labeled appliance.

3. A manual shut off valve shall be installed ahead of all controls.

6409.4 Access. Vented wall furnaces shall be provided with access for cleaning of heating surfaces; removal of burners; replacement of sections, motors, controls, filters and other working parts; and for adjustments and lubrication of parts requiring such attention. Panels, grilles and access doors that must be removed for normal servicing operations shall not be attached to the building

construction.

780 CMR 6410 VENTED ROOM HEATERS

6410.1 General. Vented room heaters shall be tested in accordance with UL 6482 or UL 896 and installed in accordance with their listing, the manufacturer's installation instructions, *the requirements of the Massachusetts Specialized Codes (248 CMR or 527 CMR)*, as applicable, and the requirements of 780 CMR 561.00 through 99.00, if applicable.

6410.2 Floor Mounting. Room heaters shall be installed on noncombustible floors or approved assemblies constructed of noncombustible materials that extend at least 18 inches (457 mm) beyond the appliance on all sides.

Exceptions:

1. Listed room heaters shall be installed on non-combustible floors, assemblies constructed of non-combustible materials or listed floor protectors with materials and dimensions in accordance with the appliance manufacturer's instructions.

2. Room heaters listed for installation on combustible floors without floor protection shall be installed in accordance with the appliance manufacturer's instructions.

780 CMR 6411 REFRIGERATION COOLING EQUIPMENT

6411.1 Approved Refrigerants. Refrigerants used in direct refrigerating systems shall conform to the applicable provisions of ANSI/ASHRAE 34.

6411.2 Refrigeration Coils in Warm-air Furnaces. Where a cooling coil is located in the supply plenum of a warm-air furnace, the furnace blower shall be rated at not less than 0.5-inch water column (124 Pa) static pressure unless the furnace is listed and labeled for use with a cooling coil. Cooling coils shall not be located upstream from heat exchangers unless listed and labeled for such use. Conversion of existing furnaces for use with cooling coils shall be permitted provided the furnace will operate within the temperature rise specified for the furnace *and such conversions otherwise conform to any applicable requirements of the Massachusetts Specialized Codes (248 CMR or 527 CMR)*.

6411.3 Condensate Disposal. Condensate from all cooling coils or evaporators shall be conveyed from the drain pan outlet an approved place of disposal (*approved disposal per the requirements of 248 CMR when applicable*). Condensate shall not discharge into a street, alley or other areas so as to cause a nuisance.

6411.3.1 Auxiliary and Secondary Drain Systems. In addition to the requirements of 780 CMR 6411.3, a secondary drain or auxiliary

drain pan shall be required for each cooling or evaporator coil where damage to any building components will occur as a result of overflow from the equipment drain pan or stoppage in the condensate drain piping. Drain piping shall be a minimum of 3/4-inch (19.1 mm) nominal pipe size. One of the following methods shall be used:

1. An auxiliary drain pan with a separate drain shall be provided under the coils on which condensation will occur. The auxiliary pan drain shall discharge to a conspicuous point of disposal to alert occupants in the event of a stoppage of the primary drain. The pan shall have a minimum depth of 1.5 inches (38 mm), shall not be less than three inches (76 mm) larger than the unit or the coil dimensions in width and length and shall be constructed of corrosion resistant material. Metallic pans shall have a minimum thickness of not less than 0.0276-inch (0.7 mm) galvanized sheet metal. Nonmetallic pans shall have a minimum thickness of not less than 0.0625 inch (1.6 mm).
2. A separate overflow drain line shall be connected to the drain pan provided with the equipment. Such overflow drain shall discharge to a conspicuous point of disposal to alert occupants in the event of a stoppage of the primary drain. The overflow drain line shall connect to the drain pan at a higher level than the primary drain connection.
3. An auxiliary drain pan without a separate drain line shall be provided under the coils on which condensate will occur. Such pan shall be equipped with a water level detection device that will shut off the equipment served prior to overflow of the pan. The auxiliary drain pan shall be constructed in accordance with 780 CMR 6411.3.1 Item 1.

6411.3.2 Drain Pipe Materials and Sizes. *Drainpipe materials shall be selected to be compatible with the condensate product carried.* Components of the condensate disposal system shall be cast iron, galvanized steel, copper, polybutylene, polyethylene, ABS, CPVC or PVC pipe or tubing. All components shall be selected for the pressure and temperature rating of the installation. Condensate waste and drain line size shall be not less than 3/4-inch (19.1 mm) internal diameter and shall not decrease in size from the drain pan connection to the place of condensate disposal. Where the drain pipes from more than one unit are manifolded together for condensate drainage, the pipe or tubing shall be sized in accordance with an approved method. All horizontal sections of drain piping shall be installed in uniform alignment at a uniform slope.

6411.4 Insulation of Refrigerant Piping. Piping and fittings for refrigerant vapor (suction) lines shall

be insulated with insulation having a thermal resistivity of at least $R = 4.0 \text{ hr} \cdot \text{ft}^2 \cdot ^\circ\text{F}/\text{Btu}$ and having external surface permeance not exceeding 0.05 perms [$2.87 \text{ ng}/(\text{s} \cdot \text{m}^2 \cdot \text{Pa})$] when tested in accordance with ASTM E 96 (*also see 780 CMR 61.00*).

780 CMR 6412 ABSORPTION COOLING EQUIPMENT

6412.1 Approval of Equipment. Absorption systems shall be installed in accordance with the manufacturer's installation instructions; *the applicable requirements of the Massachusetts Specialized Codes (248 CMR and/or 522 CMR and/or 527 CMR and/or 528 CMR), or otherwise in accordance with 780 CMR 51.00 through 99.00.*

6412.2 Condensate Disposal. Condensate from the cooling coil shall be disposed of as provided in 780 CMR 6411.3.

6412.3 Insulation of Piping. Refrigerant piping, brine piping and fittings within a building shall be insulated to prevent condensation from forming on piping (*also see 780 CMR 61.00*).

6412.4 Pressure-relief Protection. Absorption systems shall be protected by a pressure-relief device *in accordance with the requirements of 522 CMR and the manufacturer of such absorption systems.* Discharge from the pressure-relief device shall be located so as not to create a hazard to persons or property.

780 CMR 6413 EVAPORATIVE COOLING EQUIPMENT

6413.1 General. Cooling equipment that utilizes evaporation of water for cooling shall be installed in accordance with the manufacturer's installation instructions; *the applicable requirements of the Massachusetts Specialized Codes (248 CMR or 522 CMR or 527 CMR), or otherwise in accordance with 780 CMR 51.00 through 99.00.* Evaporative coolers shall be installed on a level platform or base not less than three inches (76 mm) above the adjoining ground and secured to prevent displacement. Openings in exterior walls shall be flashed in accordance with 780 CMR R5703.8.

6413.2 Protection of Potable Water. The potable water system shall be protected from backflow in accordance with the provisions of 310 CMR.

780 CMR 6414 FIREPLACE STOVES

6414.1 General. *See 780 CMR 6008.*

6414.2 Hearth Extensions. *See 780 CMR 6008.*

780 CMR 6415 MASONRY HEATERS

6415.1 General. *See 780 CMR 6006.*

EXHAUST SYSTEMS

780 CMR 6501 CLOTHES DRYERS
EXHAUST

6501.1 General. Dryer exhaust systems shall be independent of all other systems, shall convey the moisture to the outdoors and shall terminate on the outside of the building. Exhaust duct terminations shall be in accordance with the dryer manufacturer's installation instructions. Screens shall not be installed at the duct termination. Exhaust ducts shall not be connected with sheet-metal screws or fastening means which extend into the duct. Exhaust ducts shall be equipped with a backdraft damper. Exhaust ducts shall be constructed of minimum 0.016-inch-thick (0.406 mm) rigid metal ducts, having smooth interior surfaces with joints running in the direction of air flow. Flexible transition ducts used to connect the dryer to the exhaust duct system shall be limited to single lengths, not to exceed eight feet (2438 mm) in length and shall be listed and labeled in accordance with UL 2158A. Transition ducts shall not be concealed within construction.

Exception: 780 CMR 6501 shall not apply to listed and labeled condensing (ductless) clothes dryers.

6501.2 Exhaust Duct Size. The diameter of the exhaust duct shall be as required by the clothes dryer's listing and the manufacturer's installation instructions.

6501.3 Length Limitation. The maximum length of a clothes dryer exhaust duct shall not exceed 25 feet (7620 mm) from the dryer location to the wall or roof termination. The maximum length of the duct shall be reduced 2.5 feet (762 mm) for each 45-degree (0.79 rad) bend and five feet (1524 mm) for each 90-degree (1.6 rad) bend. The maximum length of the exhaust duct does not include the transition duct.

Exceptions:

1. Where a clothes dryer booster fan is installed and listed and labeled for the application, the maximum length of the exhaust duct, including any transition duct, shall be permitted to be in accordance with the booster fan manufacturer's installation instructions. Where a clothes dryer booster fan is installed and not readily accessible from the room in which the dryer is located, a permanent identifying label shall be placed adjacent to where the exhaust duct enters the wall. The label shall bear the words "This

dryer exhaust system is equipped with a remotely located booster fan."

2. Where the make and model of the clothes dryer to be installed is known and the manufacturer's installation instructions for such dryer are provided to the building official, the maximum length of the exhaust duct, including any transition duct, shall be permitted to be in accordance with the dryer manufacturer's installation instructions.

780 CMR 6502 RANGE HOODS

6502.1 General. Range hoods shall discharge to the outdoors through a single-wall duct. The duct serving the hood shall have a smooth interior surface, shall be air tight and shall be equipped with a backdraft damper. Ducts serving range hoods shall not terminate in an attic or crawl space or areas inside the building.

Exception: Where installed in accordance with the manufacturer's installation instructions, and where mechanical or natural ventilation is otherwise provided, listed and labeled ductless range hoods shall not be required to discharge to the outdoors.

6502.2 Duct Material. Single-wall ducts serving range hoods shall be constructed of galvanized steel, stainless steel or copper.

Exception: Ducts for domestic kitchen cooking appliances equipped with down draft exhaust systems shall be permitted to be constructed of schedule 40 PVC pipe provided that the installation complies with all of the following:

1. The duct shall be installed under a concrete slab poured on grade,
2. The underfloor trench in which the duct is installed shall be completely backfilled with sand or gravel,
3. The PVC duct shall extend not greater than one inch (25.4 mm) above the indoor concrete floor surface,
4. The PVC duct shall extend not greater than one inch (25.4 mm) above grade outside of the building, and
5. The PVC ducts shall be solvent cemented.

6502.3 Kitchen Exhaust Rates. Where domestic kitchen cooking appliances are equipped with ducted range hoods or down-draft exhaust systems, the fans shall be sized in accordance with 780 CMR 6506.3.

**780 CMR 6503 INSTALLATION OF
MICROWAVE OVENS**

6503.1 Installation of Microwave Oven Over a Cooking Appliance. The installation of a listed and labeled cooking appliance or microwave oven over a listed and labeled cooking appliance shall conform to the terms of the upper appliance's listing and label and the manufacturer's installation instructions. The microwave oven shall conform to UL 923.

**780 CMR 6504 OVERHEAD
EXHAUST HOODS**

6504.1 General. Domestic open-top broiler units shall be provided with a metal exhaust hood, not less than 28 gage, with a clearance of not less than 0.25 inch (6.4 mm) between the hood and the underside of combustible material or cabinets. A clearance of at least 24 inches (610 mm) shall be maintained between the cooking surface and the combustible material or cabinet. The hood shall be at least as wide as the broiler unit and shall extend over the entire unit. Such exhaust hood shall discharge to the outdoors and shall be equipped with a backdraft damper or other means to control infiltration/exfiltration when not in operation. Broiler units incorporating an integral exhaust system, and listed and labeled for use without an exhaust hood, need not be provided with an exhaust hood.

780 CMR 6505 EXHAUST DUCTS

6505.1 Ducts. Where exhaust duct construction is not specified in 780CMR 65.00, such construction shall comply with 780CMR 66.00.

**780 CMR 6506 MECHANICAL
VENTILATION**

6506.1 General. Where toilet rooms and bathrooms are mechanically ventilated, the ventilation equipment shall be installed in accordance with 780 CMR 6506.

6506.2 Recirculation of Air. Exhaust air from bathrooms and toilet rooms shall not be recirculated within a residence or to another dwelling unit.

6506.3 Ventilation Rate. Ventilation systems shall be designed to have the capacity to exhaust the minimum air flow rate determined in accordance with 780 CMR Table 6506.3.

**780 CMR TABLE 6506.3
MINIMUM REQUIRED EXHAUST RATES FOR
ONE- AND TWO-FAMILY DWELLINGS**

AREA TO BE VENTILATED	VENTILATION RATES
Kitchen	100 cfm intermittent or 25 cfm continuous
Bathrooms—Toilet Rooms	Mechanical exhaust capacity of 50 cfm intermittent or 20 cfm continuous

For SI: 1 cubic foot per minute = 0.0004719 m³/s.

780 CMR 66.00

DUCT SYSTEMS

Note: Where requirements of 248 CMR or 527 CMR are applicable, such requirements will supersede requirements of 780 CMR 66.00

780 CMR 6601 DUCT CONSTRUCTION

6601.1 Duct Design. Duct systems serving heating, cooling and ventilation equipment shall be fabricated in accordance with the provisions of 780 CMR 6601 and ACCA Manual D or other approved methods.

6601.1.1 Above-ground Duct Systems. Above-ground duct systems shall conform to the following:

1. Equipment connected to duct systems shall be designed to limit discharge air temperature to a maximum of 250°F (121°C).
2. Factory-made air ducts shall be constructed of Class 0 or Class 1 materials as designated in 780 CMR Table 6601.1.1(1).
3. Fibrous duct construction shall conform to the SMACNA "Fibrous Glass Duct Construction Standards" or NAIMA "Fibrous Glass Duct Construction Standards."
4. Minimum thicknesses of metal duct material shall be as listed in Table 6601.1.1(2). Galvanized steel shall conform to ASTM A 525.
5. Gypsum products are permitted to be used to construct return air ducts or plenums, provided that the air temperature does not exceed 125°F (52°C) and exposed surfaces are not subject to condensation.
6. Duct systems shall be constructed of materials having a flame-spread index not greater than 200.
7. Stud wall cavities and the spaces between solid floor joists to be utilized as air plenums shall comply with the following conditions:
 - 7.1. Such cavities or spaces shall not be utilized as a plenum for supply air.
 - 7.2. Such cavities or spaces shall not be part of a required fire-resistance-rated assembly.
 - 7.3. Stud wall cavities shall not convey air from more than one floor level.
 - 7.4. Stud wall cavities and joist space

plenums shall be isolated from adjacent concealed spaces by tight-fitting fire blocking in accordance with 780 CMR 5602.8.

**780 CMR TABLE 6601.1.1(1)
CLASSIFICATION OF FACTORY-MADE
AIR DUCTS**

DUCT CLASS	MAXIMUM FLAME-SPREAD RATING
0	0
1	25

6601.1.2 Underground Duct Systems. Underground duct systems shall be constructed of approved concrete, clay, metal or plastic. The maximum duct temperature for plastic ducts shall not be greater than 150°F (66°C). Metal ducts shall be protected from corrosion in an approved manner or shall be completely encased in concrete not less than two inches (51 mm) in thickness. Nonmetallic ducts shall be installed in accordance with the manufacturer's installation instructions. Plastic pipe and fitting materials shall conform to cell classification 12454-B of ASTM D 1248 or ASTM D 1784 and external loading properties of ASTM D 2412. All ducts shall slope to an accessible point for drainage. Where encased in concrete, ducts shall be sealed and secured prior to pouring any concrete. Metallic ducts having an approved protective coating and nonmetallic ducts shall be installed in accordance with the manufacturer's installation instructions.

6601.2 Factory-made Ducts. Factory-made air ducts or duct material shall be approved for the use intended, and shall be installed in accordance with the manufacturer's installation instructions. Each portion of a factory-made air duct system shall bear a listing and label indicating compliance with UL 181 and UL 181A or UL 181B.

**780 CMR TABLE 6601.1.1(2)
GAGES OF METAL DUCTS AND PLENUMS USED FOR HEATING OR COOLING**

TYPE OF DUCT	SIZE (inches)	MINIMUM THICKNESS (inch)	EQUIVALENT GALVANIZED SHEET GAGE	APPROXIMATE ALUMINUM B & S GAGE
Round ducts and enclosed rectangular duct	14 or less	0.013	30	26
	over 14	0.016	28	24
Exposed rectangular duct	14 or less	0.016	28	24
	over 14	0.019	26	22

For SI: 1 inch = 25.4 mm.

6601.2.1 Duct insulation materials. *Duct insulation materials shall conform to the following requirements (also compliance with applicable portions of 780 CMR 61.00 is required):*

1. Duct coverings and linings shall have a flame-spread index not greater than 25, and a smoke-developed index not greater than 50 when tested in accordance with ASTM E 84. Specimens tested in accordance with ASTM E 84 shall be representative of the final composite material.
2. Duct coverings and linings shall not flame, glow, smolder or smoke when tested in accordance with ASTM C 411 at the temperature to which they are exposed in service. The test temperature shall not fall below 250°F (121°C).
3. External duct insulation and factory-insulated flexible ducts shall be legibly printed or identified at intervals not greater than 36 inches (914 mm) with the name of the manufacturer; the thermal resistance R-value at the specified installed thickness; and the flame spread and smoke-developed indexes of the composite materials. All duct insulation product R-values shall be based on insulation only, excluding air films, vapor retarders or other duct components, and shall be based on tested C-values at 75°F (24°C) mean temperature at the installed thickness, in accordance with recognized industry procedures. The installed thickness of duct insulation used to determine its R-values shall be determined as follows:

- 3.1. For duct board, duct liner and factory-made rigid ducts not normally subjected to compression, the nominal insulation thickness shall be used.
- 3.2. For duct wrap, the installed thickness shall be assumed to be 75% (25% compression) of nominal thickness.
- 3.3. For factory-made flexible air ducts, the installed thickness shall be determined by dividing the difference between the actual outside diameter and nominal inside diameter by two.

6601.2.2 Vibration Isolators. Vibration isolators installed between mechanical equipment and metal ducts shall be fabricated from approved materials and shall not exceed ten inches (254 mm) in length.

6601.3 Installation. Duct installation shall comply with 780 CMR 6601.3.1 through 6601.3.8.

6601.3.1 Joints and seams (also compliance with applicable portions of 780 CMR 61.00 is required). Joints of duct systems shall be made substantially airtight by means of tapes, mastics, gasketing or other approved closure

systems. Closure systems used with rigid fibrous glass ducts shall comply with UL 181A and shall be marked "18 1A-P" for pressure-sensitive tape, "18 1A-M" for mastic or "18 1A-H" for heat-sensitive tape. Closure systems used with flexible air ducts and flexible air connectors shall comply with UL 18 1B and shall be marked "18 1B-FX" for pressure-sensitive tape or "181B-M" for mastic. Duct connections to flanges of air distribution system equipment or sheet metal fittings shall be mechanically fastened. Crimp joints for round ducts shall have a contact lap of at least 1.5 inches (38 mm) and shall be mechanically fastened by means of at least three sheet metal screws or rivets equally spaced around the joint.

6601.3.2 Support. Metal ducts shall be supported by 0.5-inch (12.7 mm) wide 18-gage metal straps or 12-gage galvanized wire at intervals not exceeding ten feet (3048 mm) or other approved means. Nonmetallic ducts shall be supported in accordance with the manufacturer's installation instructions.

6601.3.3 Fireblocking. Duct installations shall be fire-blocked in accordance with 780 CMR 5602.8.

6601.3.4 Duct insulation (also compliance with applicable portions of 780 CMR 61.00 is required). Duct insulation shall be installed in accordance with the following requirements:

1. A vapor retarder having a maximum permeance of 0.05 perm [(2.87 ng/(s · m² · Pa))] in accordance with ASTM E 96, or aluminum foil with a minimum thickness of 2 mils (0.051 mm), shall be installed on the exterior of insulation on cooling supply ducts that pass through nonconditioned spaces conducive to condensation.
2. Exterior duct systems shall be protected against the elements.
3. Duct coverings shall not penetrate a fireblocked wall or floor.

6601.3.5 Factory-made Air Ducts. Factory-made air ducts shall not be installed in or on the ground, in tile or metal pipe, or within masonry or concrete.

6601.3.6 Duct Separation. Ducts shall be installed with at least four inches (102 mm) separation from earth except where they meet the requirements of 780 CMR 6601.1.2.

6601.3.7 Ducts Located in Garages. Ducts in garages shall comply with the requirements of 780 CMR 5309.1.1.

6601.3.8 Flood Hazard Areas. In areas prone to flooding as established by 780 CMR Table 5301.2(1), duct systems shall be located or installed in accordance with 780 CMR 5323.1.5.

6601.4 Under-floor Plenums. An under-floor space used as a supply plenum shall conform to the requirements of 780 CMR 6601. Fuel gas lines and plumbing waste cleanouts shall not be located within the plenum space.

6601.4.1 General. The space shall be cleaned of loose combustible materials and scrap, and shall be tightly enclosed. The ground surface of the space shall be covered with a moisture barrier having a minimum thickness of four mils (0.102 mm).

6601.4.2 Materials. The under-floor space, including the sidewall insulation, shall be formed by materials having flame-spread ratings not greater than 200 when tested in accordance with ASTM E 84.

6601.4.3 Furnace Connections. A duct shall extend from the furnace supply outlet to not less than six inches (152 mm) below the combustible framing. This duct shall comply with the provisions of 780 CMR 6601.1. A noncombustible receptacle shall be installed below any floor opening into the plenum in accordance with the following requirements:

1. The receptacle shall be securely suspended from the floor members and shall not be more than 18 inches (457 mm) below the floor opening.
2. The area of the receptacle shall extend three inches (76 mm) beyond the opening on all sides.
3. The perimeter of the receptacle shall have a vertical lip at least one inch (25.4 mm) high at the open sides.

6601.4.4 Access. Access to an under-floor plenum shall be provided through an opening in the floor with minimum dimensions of 18 inches by 24 inches (457 mm by 610 mm).

6601.4.5 Furnace Controls. The furnace shall be equipped with an automatic control that will start the air-circulating fan when the air in the furnace bonnet reaches a temperature not greater than 150°F (66°C). The furnace shall additionally be equipped with an approved automatic control that limits the outlet air temperature to 200°F (93°C).

780 CMR 6602 RETURN AIR

6602.1 Return Air. Return air shall be taken from inside the dwelling. Dilution of return air with outdoor air shall not be prohibited.

6602.2 Prohibited Sources. Outside or return air for a forced-air heating or cooling system shall not be taken from the following locations:

1. Closer than ten feet (3048 mm) from an appliance vent outlet, a vent opening from a

plumbing drainage system or the discharge outlet of an exhaust fan, unless the outlet is three feet (914 mm) above the outside air inlet.

2. Where there is the presence of flammable vapors; or where located less than 10 feet (3048 mm) above the surface of any abutting public way or driveway; or where located at grade level by a sidewalk, street, alley or driveway.

3. A room or space, the volume of which is less than 25% of the entire volume served by such system. Where connected by a permanent opening having an area sized in accordance with ACCA Manual D, adjoining rooms or spaces shall be considered as a single room or space for the purpose of determining the volume of such rooms or spaces.

Exception: The minimum volume requirement shall not apply where the amount of return air taken from a room or space is less than or equal to the amount of supply air delivered to such room or space.

4. A closet, bathroom, toilet room, kitchen, garage, mechanical room, furnace room or other dwelling unit.

5. A room or space containing a fuel-burning appliance where such room or space serves as the sole source of return air.

Exceptions:

1. The fuel-burning appliance is a direct-vent appliance or an appliance not requiring a vent in accordance with 780 CMR 6801.1 or 780 CMR 74.00.

2. The room or space complies with the following requirements:

- 2.1. The return air shall be taken from a room or space having a volume exceeding one cubic foot for each ten Btu/h (9.6 L/W) of combined input rating of all fuel-burning appliances therein.

- 2.2. The volume of supply air discharged back into the same space shall be approximately equal to the volume of return air taken from the space.

- 2.3. Return-air inlets shall not be located within ten feet (3048 mm) of any appliance firebox or draft hood in the same appliances, provided that return-air inlets are located not less than ten feet (3048 mm) from the firebox of such appliances.

6602.3 Inlet Opening Protection. Outdoor air inlets shall be covered with screens having not less than ¼-inch (6.4 mm) openings and not greater than ½-inch (12.7 mm) openings.

NON-TEXT PAGE

COMBUSTION AIR

780 CMR 6701 GENERAL

6701.1 Air Supply. Liquid and solid fuel-burning appliances shall be provided with a supply of air for fuel combustion, draft hood dilution and ventilation of the space in which the appliance is installed, in accordance with *the requirements of 248 CMR or 527 CMR, as applicable*. The methods of providing combustion air in 780 CMR 67.00 do not apply to fireplaces, fireplace stoves and *solid fuel-burning* direct-vent appliances.

6701.1.1 Buildings of Unusually Tight Construction. (*Note: For fossil fuel-burning appliances, refer to 248 CMR or 527 CMR, as applicable*). In buildings of unusually tight construction, combustion air shall be obtained from outside the sealed thermal envelope. In buildings of ordinary tightness, insofar as infiltration is concerned, all or a portion of the combustion air for fuel-burning appliances may be obtained from infiltration when the room or space has a volume of 50 cubic feet per 1,000 Btu/h (4.83 L/W) input.

6701.2 Exhaust and Ventilation System. Air requirements for the operation of exhaust fans, kitchen ventilation systems, clothes dryers and fireplaces shall be considered in determining the adequacy of a space to provide combustion air.

6701.3 Volume Dampers Prohibited. (*Note: For fossil fuel-burning appliances, refer to 248 CMR or 527 CMR, as applicable*). Volume dampers shall not be installed in combustion air openings.

6701.4 Prohibited Sources. Combustion air ducts and openings shall not connect appliance enclosures with space in which the operation of a fan may adversely affect the flow of combustion air. Combustion air shall not be obtained from an area in which flammable vapors present a hazard. *For fossil fuel-fired appliances, refer to 248 CMR or 527 CMR to determine prohibited sources of combustion air. Unless allowed by 248 CMR or 527 CMR or 780 CMR 51.00 through 99.00 as applicable, fuel-fired appliances shall not obtain combustion air from any of the following rooms or spaces:*

1. Sleeping rooms.
2. Bathrooms.
3. Toilet rooms.

Exception: The following appliances shall be permitted to obtain combustion air from sleeping rooms, bathrooms and toilet rooms:

1. Solid fuel-fired appliances provided that the room is not a confined space and the

building is not of unusually tight construction.

2. *Appliances, allowed by 248 CMR or 527 CMR or 780 CMR 51.00 through 99.00 and the manufacturer's requirements, as applicable, and installed in an enclosure in which all combustion air is taken from the out-doors and the enclosure is equipped with a solid weatherstripped door and self-closing device.*

6701.5 Opening Area (refer to 248 CMR or 527 CMR when applicable). The free area of each opening shall be used for determining combustion air. Unless otherwise specified by the manufacturer or determined by actual measurement, the free area shall be considered 75% of the gross area for metal louvers and 25% of the gross area for wood louvers.

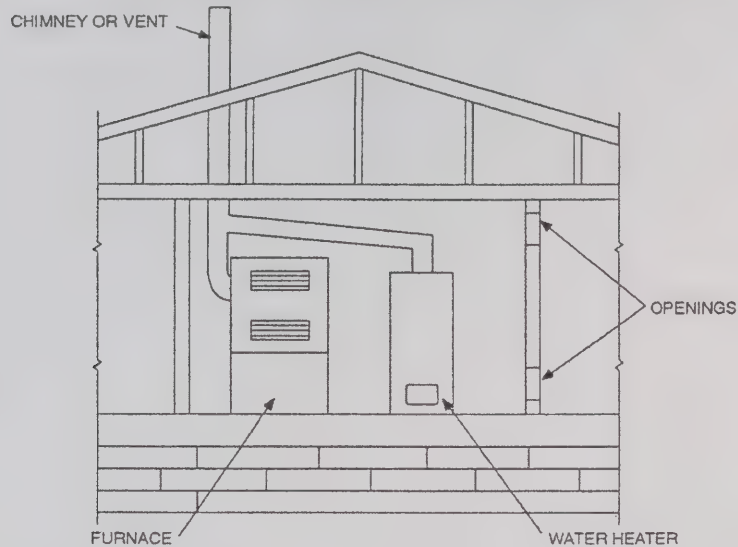
6701.6 Opening Location. In areas prone to flooding as established by 780 CMR Table 5301.2(1), openings shall be located at or above the design flood elevation established in 780 CMR 5323.1.3.

780 CMR 6702 ALL AIR FROM INSIDE THE BUILDING

6702.1 Required Volume. (*Note: For fossil fuel-burning appliances, refer to 248 CMR or 527 CMR, as applicable*). Where the volume of the space in which fuel-burning appliances are installed is greater than 50 cubic feet per 1,000 Btu/h (4.83 L/W) of aggregate input rating in buildings of ordinary tightness, insofar as infiltration is concerned, normal infiltration shall be regarded as adequate to provide combustion air. Rooms communicating directly with the space in which the appliances are installed through openings not furnished with doors shall be considered part of the required volume.

6702.2 Confined Space. Where the space in which the appliance is located does not meet the criterion specified in 780 CMR 6702.1, two permanent openings to adjacent spaces shall be provided so that the combined volume of all spaces meets the criterion. One opening shall be within 12 inches (305 mm) of the top and one within 12 inches (305 mm) of the bottom of the space, as illustrated in 780 CMR Figure 6702.2. Each opening shall have a free area equal to a minimum of one square inch per 1,000 Btu/h (2.20 mm²/W) input rating of all appliances installed within the space, but not less than 100 square inches (0.064 m²).

780CMR FIGURE 6702.2
APPLIANCES LOCATED IN CONFINED SPACES—ALL AIR TAKEN FROM
ADJACENT SPACES WITHIN THE BUILDING



For SI: 1 square inch = 645.16 mm², 1 British thermal unit per hour = 0.2931 W.

NOTE: Each opening shall have a free area of not less than 1 square inch per 1,000 Btu/h of the total input rating of all appliances in the enclosure, but not less than 100 square inches.

6702.3 Unusually Tight Construction. Where the space is of adequate volume in accordance with 780 CMR 6702.1 or 780 CMR 6702.2, but is within a building sealed so tightly that infiltration air is not adequate for combustion, combustion air shall be obtained from outdoors or from spaces freely communicating with the outdoors in accordance with 780 CMR 6703.

780 CMR 6703 ALL AIR FROM OUTDOORS

6703.1 Outdoor Air. (*Note: For fossil fuel-burning appliances, refer to 248 CMR or 527 CMR, as applicable*). Where the space in which fuel-burning appliances are located does not meet the criterion for indoor air specified in 780 CMR 6702, outside combustion air shall be supplied as specified in 780 CMR 6703.2.

6703.2 Two Openings or Ducts. Outside combustion air shall be supplied through openings or ducts, as illustrated in Figures 6703.2(1), 6703.2(2), 6703.2(3) and 6703.2(4). One opening shall be within 12 inches (305 mm) of the top of the enclosure, and one within 12 inches (305 mm) of the bottom of the enclosure. Openings are permitted to connect to spaces directly communicating with the outdoors, such as ventilated crawl spaces or ventilated attic spaces. The same duct or opening shall not serve both combustion air openings. The duct serving the upper opening shall be level or extend upward from the appliance space.

6703.2.1 Size of Openings. Where communicating with the outdoors by means of vertical ducts, each opening shall have a free area of at least one square inch per 4,000 Btu/h (0.550 mm²/W) of total input rating of all appliances in

the space. Where horizontal ducts are used, each opening shall have a free area of at least one square inch per 2,000 Btu/h (0.275 mm²/W) of total input of all appliances in the space. Ducts shall be of the same minimum cross-sectional area as the required free area of the openings to which they connect. The minimum cross-sectional dimension of rectangular air ducts shall be three inches (76 mm).

6703.3 Attic Combustion Air. Combustion air obtained from an attic area, as illustrated in 780 CMR Figure 6703.2(3), shall be in accordance with the following:

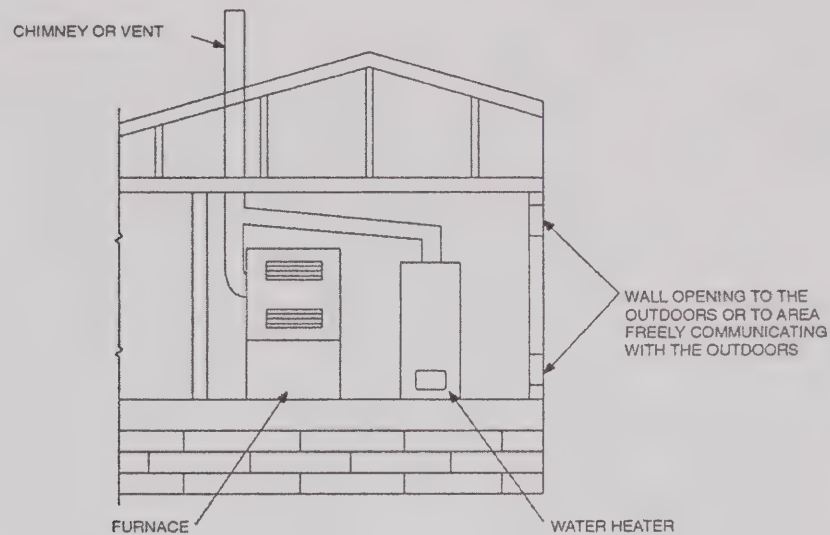
1. The attic ventilation shall be sufficient to provide the required volume of combustion air.
2. The combustion air opening shall be provided with a metal sleeve extending from the appliance enclosure to at least six inches (152 mm) above the top of the ceiling joists and ceiling insulation.
3. An inlet air duct within an outlet air duct shall be an acceptable means of supplying attic combustion air to an appliance room provided that the inlet duct extends at least 12 inches (305 mm) above the top of the outlet duct in the attic space, as illustrated in 780 CMR Figure 6703.3.
4. The end of ducts that terminate in an attic shall not be screened.

6703.4 Under-floor Combustion Air. Combustion air obtained from under-floor areas, as illustrated in 780 CMR Figure 6703.2(4), shall have free opening areas to the outside equivalent to not less than twice the required combustion air opening.

6703.5 Opening Requirements. Outside combustion air openings shall be covered with

corrosion-resistant screen or equivalent protection and not greater than 0.5-inch (12.7 mm) openings, having not less than 0.25-inch (6.4 mm) openings,

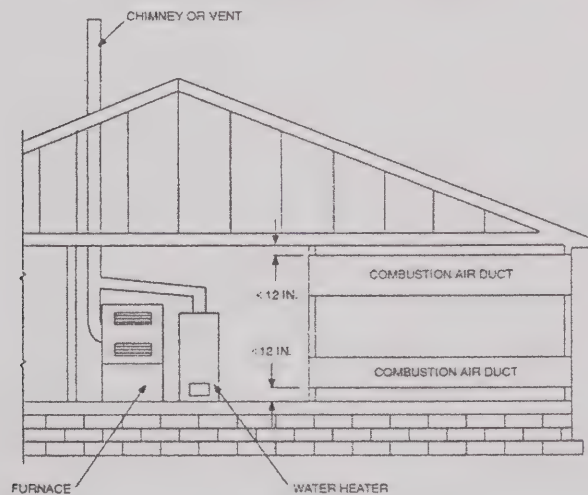
780 CMR FIGURE 6703.2(1)
APPLIANCES LOCATED IN CONFINED SPACES—ALL AIR TAKEN FROM OUTDOORS
THROUGH TWO OPENINGS



For SI: 1 square inch = 645.16 mm², 1 British thermal unit per hour = 0.293 1 W.

NOTE: Each opening shall have a free area of not less than 1 square inch per 4,000 Btu/h of the total input rating of all appliances in the enclosure.

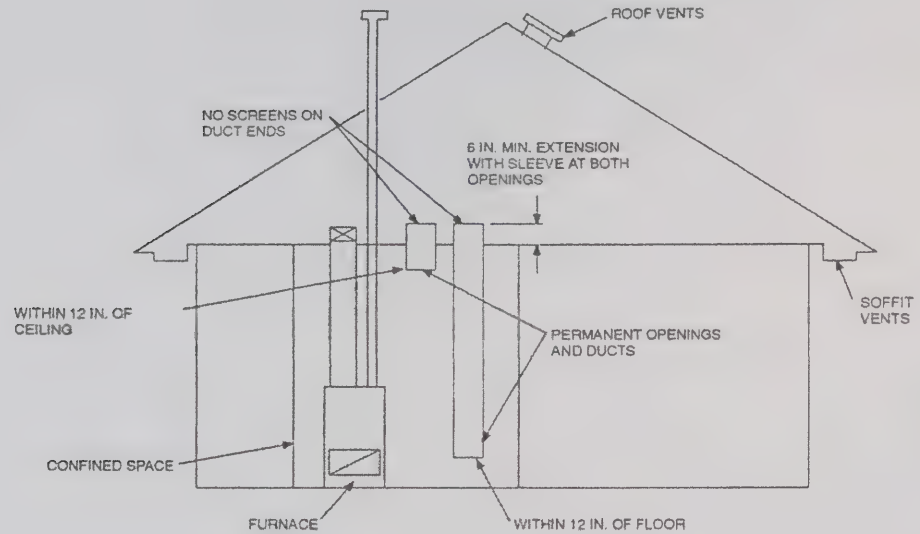
780 CMR FIGURE 6703.2(2)
APPLIANCES LOCATED IN CONFINED SPACES—ALL AIR TAKE FROM OUTDOORS
THROUGH HORIZONTAL DUCTS



For SI: 1 inch = 25.4 mm, 1 square inch = 645.16 mm², 1 British thermal unit per hour = 0.293 1 W.

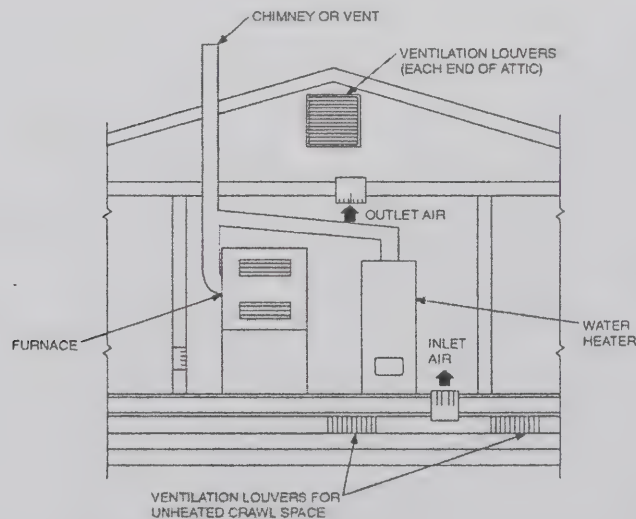
NOTE: Each opening shall have a free area of at least 1 square inch per 2,000 Btu/h of the total input of all appliances in the space.

780 CMR FIGURE 6703.2(3)
APPLIANCES LOCATED IN CONFINED SPACES—ALL AIR TAKEN FROM OUTDOORS
THROUGH VENTILATED ATTIC



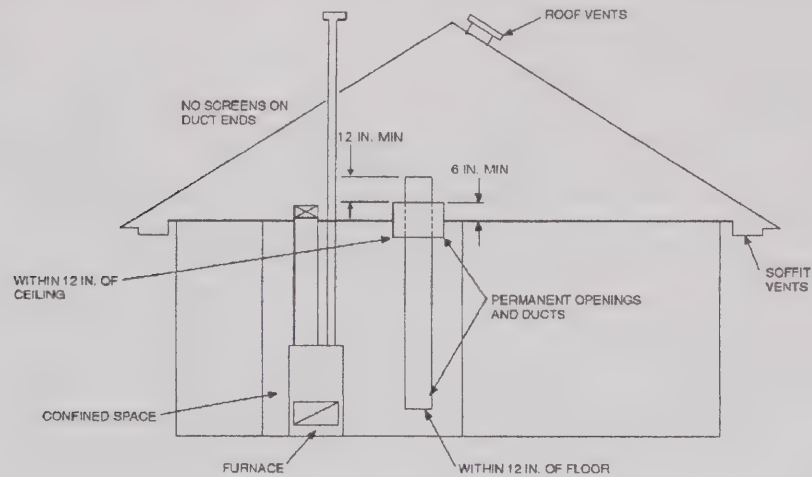
For SI: 1 inch = 25.4 mm, 1 British thermal unit per hour = 0.293 1 W, 1 square inch = 645.16 mm².
NOTE: Each opening shall have a free area of at least 1 square inch per 4,000 Btu/h of the total input of all appliances in the space. The attic must be sufficiently vented for combustion air to be taken from the attic.

780 CMR FIGURE 6703.2(4)
APPLIANCES LOCATED IN CONFINED SPACES—INLET AIR TAKEN FROM
VENTILATED CRAWL SPACE AND OUTLET AIR TO VENTILATED ATTIC



For SI: 1 square inch = 645.16 mm², 1 British thermal unit per hour = 0.2931 W.
NOTE: The inlet and outlet air openings shall have a free area of not less than 1 square inch per 4,000 Btu/h of the total input rating of all appliances in the enclosure.

780 CMR FIGURE 6703.3
APPLIANCES LOCATED IN CONFINED SPACES—ALL AIR TAKEN FROM
OUTDOORS THROUGH VENTILATED ATTIC, INLET DUCT WITHIN OUTLET DUCT



For SI: 1 inch = 25.4 mm, 1 British thermal unit per hour = 0.2931 W, 1 square inch = 645.16 mm².

NOTE: Each duct shall have a free area of at least 1 square inch per 4,000 Btu/h of the total input of all appliances in the space. The attic must be sufficiently ventilated to provide the required combustion air.

NON-TEXT PAGE

CHIMNEYS AND VENTS

780 CMR 6801 GENERAL

6801.1 Venting Required. Fuel-burning appliances shall be vented to the outside in accordance with their listing and label and manufacturer's installation instructions except appliances listed and labeled for unvented use. Venting systems shall consist of approved chimneys or vents, or venting assemblies that are integral parts of labeled appliances. *Gas-fired appliances shall be vented per the requirements of 248 CMR and the manufacturer's requirements. Oil-fired appliances shall be vented per the requirements of 527 CMR and the manufacturer's requirements. Solid fuel-burning appliances shall be vented per the requirements of 780 CMR 51.00 through 99.00 and the manufacturer's requirements.*

6801.2 Draft Requirements. A venting system shall satisfy the draft requirements of the appliance in accordance with the manufacturer's installation instructions, and shall be constructed and installed to develop a positive flow to convey combustion products to the outside atmosphere.

6801.3 Existing Chimneys and Vents. Where an appliance is permanently disconnected from an existing chimney or vent, or where an appliance is connected to an existing chimney or vent during the process of a new installation, the chimney or vent shall comply with 780 CMR 6801.3.1 through 6801.3.4.

6801.3.1 Size. The chimney or vent shall be resized as necessary to control flue gas condensation in the interior of the chimney or vent and to provide the appliance, or appliances served, with the required draft. *For the venting of gas and oil-fired appliances to masonry chimneys, the resizing shall be done in accordance with 248 CMR or 527 CMR, as applicable; for solid fuel-fired appliances, chimney resizing shall be in accordance with 780 CMR 51.00 through 99.00 and the manufacturer's requirements.*

6801.3.2 Flue Passageways. The flue gas passageway shall be free of obstructions and combustible deposits and shall be cleaned if previously used for venting a solid or liquid fuel-burning appliance or fireplace. The flue liner, chimney inner wall or vent inner wall shall be continuous and free of cracks, gaps, perforations, or other damage or deterioration that would allow the escape of combustion products, including gases, moisture and creosote.

6801.3.3 Cleanout. Masonry chimneys shall be provided with a cleanout opening complying with

780 CMR 6001.14.

6801.3.4 Clearances. Chimneys and vents shall have airspace clearance to combustibles in accordance with 780 CMR 51.00 through 99.00 and the chimney or vent manufacturer's installation instructions.

Exception: Masonry chimneys equipped with a chimney lining system tested and listed for installation in chimneys in contact with combustibles in accordance with UL 1777, and installed in accordance with the manufacturer's instruction, shall not be required to have a clearance between combustible materials and exterior surfaces of the masonry chimney. Noncombustible firestopping shall be provided in accordance with 780 CMR 51.00 through 99.00.

6801.4 Space around Lining. The space surrounding a flue lining system or other vent installed within a masonry chimney shall not be used to vent any other appliance. This shall not prevent the installation of a separate flue lining in accordance with the manufacturer's installation instructions and 780 CMR 51.00 through 99.00.

6801.5 Mechanical Draft Systems. A mechanical draft system shall be used only with appliances listed and labeled for such use. Provisions shall be made to prevent the flow of fuel to the equipment when the draft system is not operating. Forced draft systems and all portions of induced draft systems under positive pressure during operation shall be designed and installed so as to prevent leakage of flue gases into a building.

6801.6 Direct-vent Appliances. Direct-vent appliances shall be installed in accordance with the manufacturer's installation instructions.

6801.7 Support. Venting systems shall be adequately supported for the weight of the material used.

6801.8 Duct Penetrations. Chimneys, vents and vent connectors shall not extend into or through supply and return air ducts or plenums.

6801.9 Fireblocking. Vent and chimney installations shall be fireblocked in accordance with 780 CMR 5602.8.

6801.10 Unused Openings. Unused openings in any venting system shall be closed or capped (*also see 248 CMR or 527 CMR when applicable*).

6801.11 Multiple-Appliance Venting Systems. *Two or more listed and labeled fossil fuel-fired appliances shall not be connected to a common natural draft venting system unless permitted per applicable requirements of 248 CMR or 527 CMR. For solid fuel-burning appliances, see 780 CMR 6801.12.*

6801.12 Multiple Solid Fuel Prohibited. A solid fuel-burning appliance or fireplace shall not connect to a chimney passageway venting another appliance.

780 CMR 6802 VENT COMPONENTS

6802.1 Draft hoods. *See 248 CMR or 527 CMR, as applicable.*

6802.2 Vent Dampers. *See 248 CMR or 527 CMR, as applicable, except that solid fuel-burning appliances shall conform with 780 CMR 6802.2.1.*

6802.2.1 Manually Operated. Manually operated dampers shall not be installed except in connectors or chimneys serving solid-fuel-burning appliances.

6802.3 Draft Regulators. *For fossil fuel-fired appliances, see 248 CMR or 527 CMR, as applicable.* Draft regulators provided for solid-fuel-burning appliances to reduce draft intensity shall be installed and set in accordance with the manufacturer's installation instructions.

6802.3.1 Location. Where required, draft regulators shall be installed in the same room or enclosure as the appliance so that no difference in pressure will exist between the air at the regulator and the combustion air supply.

780 CMR 6803 CHIMNEY AND VENT CONNECTORS

6803.1 General. Connectors shall be used to connect fuel-burning appliances to a vertical chimney or vent except where the chimney or vent is attached directly to the appliance.

6803.2 Connectors for Oil and Solid Fuel Appliances. *Connectors for gas and oil-fired appliances shall conform to the requirements of 248 CMR or 527 CMR, as applicable. Connectors for solid-fuel-burning appliances shall be constructed of factory-built chimney material, Type L vent material or single-wall metal pipe having resistance to corrosion and heat and thickness not less than that of galvanized steel as specified in 780 CMR Table 6803.2.*

780 CMR TABLE 6803.2
THICKNESS FOR SINGLE-WALL METAL PIPE
CONNECTORS FOR SOLID FUEL-BURNING
APPLIANCES

DIAMETER OF CONNECTOR (inches)	GALVANIZED SHEET METAL GAGE NUMBER	MINIMUM THICKNESS (inch)
Less than 6	26	0.019
6 to 10	24	0.024
Over 10 through 16	22	0.029

For SI: 1 inch = 25.4 mm.

6803.3 Installation. Vent and chimney connectors shall be installed in accordance with *requirements of 248 CMR or 527 CMR or 780 CMR 51.00 through 99.00, as applicable*, and the manufacturer's installation instructions and within the space that the appliance is located. Appliances shall be located as close as practical to the vent or chimney. Connectors shall be as short and straight as possible and installed with a slope of not less than ¼ inch (6.4 mm) rise per foot of run. Connectors shall be securely supported and joints shall be fastened with sheet metal screws or rivets. Devices that obstruct the flow of flue gases shall not be installed in a connector unless listed and labeled or approved for such installations.

6803.3.1 Floor, Ceiling and Wall Penetrations.

A chimney connector or vent connector shall not pass through any floor or ceiling. A chimney connector or vent connector shall not pass through a wall or partition unless the connector is listed and labeled for wall pass-through, or is routed through a device listed and labeled for wall pass-through and is installed in accordance with the conditions of its listing and label. Connectors for oil-fired appliances listed and labeled for Type L vents, passing through walls or partitions shall be in accordance with the following:

1. Type L vent material for oil appliances shall be installed with not less than listed and labeled clearances to combustible material.
2. Single-wall metal pipe shall be guarded by a ventilated metal thimble not less than four inches (102 mm) larger in diameter than the vent connector. A minimum six inches (152 mm) of clearance shall be maintained between the thimble and combustibles.

6803.3.2 Length. The horizontal run of an uninsulated connector to a natural draft chimney shall not exceed 75% of the height of the vertical portion of the chimney above the connector. The horizontal run of a listed connector to a natural draft chimney shall not exceed 100% of the height of the vertical portion of the chimney above the connector.

6803.3.3 Size. A connector shall not be smaller than the flue collar of the appliance.

Exception: Where installed in accordance with the appliance manufacturer's installation instructions.

6803.3.4 Clearance. Connectors shall be installed with clearance to combustibles as set forth in 780 CMR Table 6803.3.4. Reduced clearances to combustible materials shall be in accordance with 780 CMR Table 6306.2 and 780 CMR Figure 6306.1.

**780 CMR TABLE 6803.3.4
CHIMNEY AND VENT CONNECTOR (SOLID
FUEL-BURNING APPLIANCES) CLEARANCES
TO COMBUSTIBLE MATERIALS***

TYPE OF CONNECTOR	MINIMUM CLEARANCE (inches)
Single-wall metal pipe connectors: Solid-fuel appliances	18
Type L vent piping connectors: Solid-fuel appliances	9

For SI: 1 inch = 25.4 mm.

a. These minimum clearances apply to unlisted single-wall chimney and vent connectors. Reduction of required clearances is permitted as in 780 CMR Table 6306.2.

6803.3.5 Access. The entire length of a connector shall be accessible for inspection, cleaning and replacement.

6803.4 Connection to Fireplace Flue. Connection of appliances to chimney flues serving fireplaces shall comply with 780 CMR 6803.4.1 through 6803.4.4.

6803.4.1 Closure and Accessibility. A noncombustible seal shall be provided below the point of connection to prevent entry of room air into the flue. Means shall be provided for access to the flue for inspection and cleaning.

6803.4.2 Connection to Factory-built Fireplace Flue. A different appliance shall not be connected to a flue serving a factory-built fireplace unless the appliance is specifically listed for such an installation. The connection shall be made in conformance with the appliance manufacturer's instructions.

6803.4.3 Connection to Masonry Fireplace Flue. A connector shall extend from the appliance to the flue serving a masonry fireplace such that the flue gases are conveyed directly into the flue. The connector shall be accessible or removable for inspection and cleaning of both the connector and the flue. Listed direct connection devices shall be installed in accordance with their listing.

6803.4.4 Size of Flue. The size of the fireplace flue shall be in accordance with 780 CMR 6805.3.1.

780 CMR 6804 VENTS

6804.1 Type of Vent Required. Appliances shall be provided with a listed and labeled venting system as set forth in 780 CMR Table 6804.1.

**780 CMR TABLE 6804.1
VENT SELECTION CHART – PELLET VENTS**

PELLET VENTS
Pellet fuel burning
Pellet fuel-burning appliances listed and labeled for use with pellet vents

6804.2 Termination. Vent termination shall comply with 780 CMR 6804.2.1 through 6804.2.6.

6804.2.1 Through the Roof. Vents passing through a roof shall extend through flashing and terminate in accordance with the manufacturer's installation requirements.

6804.2.2 Decorative Shrouds. Decorative shrouds shall not be installed at the termination of vents except where such shrouds are listed and labeled for use with the specific venting system and are installed in accordance with the manufacturer's installation instructions.

6804.2.3 Natural Draft Appliances. Vents for natural draft appliances shall terminate at least five feet (1524 mm) above the highest connected appliance outlet, and natural draft gas vents serving wall furnaces shall terminate at an elevation at least 12 feet (3658 mm) above the bottom of the furnace.

6804.2.4 Type L Vent. Type L venting systems shall conform to UL 641. Such vents shall terminate with a listed and labeled cap in accordance with the vent manufacturer's installation instructions not less than two feet (610 mm) above the roof and not less than two feet (610mm) above any portion of the building within ten feet (3048 mm).

6804.2.5 Direct Vent Terminations. Vent terminals for direct-vent appliances shall be installed in accordance with the manufacturer's installation instructions.

6804.2.6 Mechanical Draft Systems. Mechanical draft systems shall be installed in accordance with their listing, the manufacturer's installation instructions and, except for direct vent appliances, the following requirements:

1. The vent terminal shall be located not less than three feet (914 mm) above a forced air inlet located within ten feet (3048 mm).
2. The vent terminal shall be located not less than four feet (1219 mm) below, four feet (1219 mm) horizontally from, or one foot (305 mm) above any door, window or gravity air inlet into a dwelling.
3. The vent termination point shall not be

located closer than three feet (914 mm) to an interior corner formed by two walls perpendicular to each other.

4. The bottom of the vent terminal shall be located at least 12 inches (305mm) above finished ground level.

5. The vent termination shall not be mounted directly above or within three feet (914mm) horizontally from an oil tank vent or gas meter.

6. Power exhaustor terminations shall be located not less than ten feet (3048 mm) from lot lines and adjacent buildings.

7. The discharge shall be directed away from the building.

6804.3 Installation. Type L and pellet vents shall be installed in accordance with the terms of their listing and label and the manufacturer's installation instructions.

6804.3.1 Size of Single Appliance Venting Systems. An individual vent for a single appliance shall have a cross-sectional area equal to or greater than the area of the connector to the appliance, but not less than seven square inches (4515 mm²) except where the vent is an integral part of a listed and labeled appliance.

780 CMR 6805 MASONRY AND FACTORY-BUILT CHIMNEYS

6805.1 General. Masonry and factory-built chimneys shall be built and installed in accordance with 780 CMR 6001 and 6002, respectively. Flue lining for masonry chimneys shall comply with 780 CMR 6001.8.

6805.2 Masonry Chimney Connection. A chimney connector shall enter a masonry chimney not less than six inches (152 mm) above the bottom of the chimney. Where it is not possible to locate the connector entry at least six inches (152 mm) above the bottom of the chimney flue, a cleanout shall be provided by installing a capped tee in the connector next to the chimney. A connector entering a masonry chimney shall extend through, but not beyond the wall and shall be flush with the inner face of the liner. Connectors, or thimbles where used, shall be firmly cemented into the masonry.

6805.3 Size of Chimney Flues. *For fossil fuel-fired appliances, see 248 CMR or 527 CMR, as applicable.*

6805.3.1 Size of Chimney Flue for Solid Fuel Appliance. Except where otherwise specified in the manufacturer's installation instructions, the cross-sectional area of a flue connected to a solid-fuel-burning appliance shall be not less than the area of the flue collar or connector, and not larger than three times the area of the flue collar.

SPECIAL FUEL-BURNING EQUIPMENT

780 CMR 6901 RANGES AND OVENS

6901.1 Clearances. *The requirements of 248 CMR or 527 CMR and the appliance manufacturer shall apply when applicable; otherwise, freestanding or built-in ranges shall have a vertical clearance above the cooking top of not less than 30 inches (762 mm) to unprotected combustible material. Reduced clearances are permitted in accordance with the listing and labeling of the range hoods or appliances.*

6901.2 Cooking Appliances. Household cooking appliances shall be listed and labeled and shall be installed in accordance with the manufacturer's installation instructions. The installation shall not interfere with combustion air or accessibility for operation and servicing.

780 CMR 6902 SAUNA HEATERS

6902.1 Locations and Protection. *Sauna heaters shall be protected from accidental contact by persons with a guard of material having a low thermal conductivity, such as wood. The guard shall have no substantial effect on the transfer of heat from the heater to the room. Where 248 CMR or 527 CMR regulate sauna heater protection, such regulations shall apply.*

6902.2 Installation. *Sauna heaters shall be installed in accordance with the manufacturer's installation instructions and any requirements of either 248 CMR or 527 CMR, when applicable.*

6902.3 Combustion Air. Combustion air and venting for a nondirect vent-type heater shall be provided in accordance with Chapters 67 and 68, respectively.

6902.4 Controls. *Where 248 CMR or 527 CMR regulate sauna heater thermostat requirements to control maximum room temperature, such regulations shall apply, otherwise sauna heaters shall be equipped with a thermostat that will limit room temperature to not greater than 194°F (90°C). Where the thermostat is not an integral part of the heater, the heat-sensing element shall be located within six inches (152 mm) of the ceiling.*

780 CMR 6903 STATIONARY FUEL CELL POWER PLANTS

6903.1 General. Stationary fuel cell power plants having a power output not exceeding 1,000kW, shall be tested in accordance with ANSI Z21.83 and shall be installed in accordance with the manufacturer's installation instructions and NFPA 853.

NON-TEXT PAGE

BOILERS AND WATER HEATERS

780 CMR 7001 BOILERS

7001.1 Jurisdiction. The design, installation, maintenance, alteration and/or inspection of boilers and water heaters that are permanently installed and utilized to provide control of environmental conditions within buildings is controlled by 248 CMR, 522 CMR, 527 CMR or 528 CMR, as applicable, and the requirements of such Specialized Codes shall govern.

1. 248 CMR - "Fuel Gas and Plumbing Code"
2. 522 CMR - "Board of Boiler Rules"
3. 527 CMR - "Fire Code"
4. 527 CMR 12.00 - "Massachusetts Electrical Code"

5. 528 CMR - "Bureau of Pipefitters and Refrigeration Technicians"

Exception: Solid fuel-fired boilers and water heaters may additionally require the approval of the BBRS.

7001.2 Flood-resistant Installation. In areas prone to flooding as established in 780 CMR 53.00 (Flood Insurance Rate Maps or other), boilers, water heaters and their control systems shall be located or installed in accordance with 780 CMR 5323.1.5.

NON-TEXT PAGE

HYDRONIC PIPING

780 CMR 7101 HYDRONIC PIPING
SYSTEMS INSTALLATION

7101.1 Jurisdiction. *Where the design, installation, maintenance, alteration and/or inspection of hydronic piping permanently installed within buildings is controlled by 248 CMR, 522 CMR, 527 CMR or 528 CMR, as applicable, the requirements of such Specialized Codes shall govern except that drilling, cutting and notching of building structural elements and penetration of building fire-rated assemblies shall conform to requirements of 780 CMR 51.00 through 99.00. If such Massachusetts Specialized Codes do not govern, then the following requirements of 780 CMR 51.00 through 99.00 shall apply:*

1. 248 CMR – “Fuel Gas and Plumbing Code”
2. 522 CMR – “Board of Boiler Rules”
3. 527 CMR – “Fire Code”
4. 527 CMR 12.00 – “Massachusetts Electrical Code”
5. 528 CMR – “Bureau of Pipefitters and Refrigeration Technicians”
6. Other applicable Massachusetts Specialized Codes.

7101.2 General. Hydronic piping shall conform to 780 CMR Table 7101.2. Approved piping, valves, fittings and connections shall be installed in accordance with the manufacturer’s installation instructions. Pipe and fittings shall be rated for use at the operating temperature and pressure of the hydronic system. Used pipe, fittings, valves or other materials shall be free of foreign materials.

7101.3 System Drain Down. *Hydronic piping systems shall be installed to permit the system to be drained. When the system drains to the plumbing drainage system, the installation shall conform to the requirements of 248 CMR.*

7101.4 Protection of Potable Water. *The potable water system shall be protected from backflow in accordance with any applicable requirements of 248 CMR and/or 310 CMR.*

7101.5 Pipe Penetrations. Openings through concrete or masonry building elements shall be sleeved.

7101.6 Contact with Building Material. A hydronic piping system shall not be in direct contact with any building material that causes the piping material to degrade or corrode.

7101.7 Drilling and Notching. Wood-framed structural members shall be drilled, notched or altered in accordance with the provisions of

780 CMR 7502.6, 7602.6, 7602.6.1 and 7802.6. Holes in cold-formed, steel-framed, load-bearing members shall only be permitted in accordance with 780 CMR 7506.2, 7603.2 and 7804.2. Cutting and notching of flanges and lips of cold-formed, steel-framed, load-bearing members shall not be permitted in accordance with the provisions of 780 CMR 7505.3.5, 7603.3.4 and 7804.3.5.

7101.8 Prohibited Tee Applications. Fluid in the supply side of a hydronic system shall not enter a tee fitting through the branch opening.

7101.9 Expansion, Contraction and Settlement. Piping shall be installed so that piping, connections and equipment shall not be subjected to excessive strains or stresses. Provisions shall be made to compensate for expansion, contraction, shrinkage and structural settlement.

7101.10 Piping Support. Hangers and supports shall be of material of sufficient strength to support the piping, and shall be fabricated from materials compatible with the piping material. Piping shall be supported at intervals not exceeding the spacing specified in 780 CMR Table 7101.10.

7101.11 Tests. Hydronic piping shall be tested hydrostatically at a pressure of not less than 100 pounds per square inch (psi) (689 kPa) for a duration of not less than 15 minutes.

780 CMR 7102 BASEBOARD CONVECTORS

7102.1 General. Baseboard convectors shall be installed in accordance with the manufacturer’s installation instructions. Convectors shall be supported independently of the hydronic piping.

780 CMR 7103 FLOOR HEATING SYSTEMS

7103.1 Piping Materials. Piping for embedment in concrete or gypsum materials shall be standard-weight steel pipe, copper tubing, cross-linked polyethylene/aluminum/cross-linked polyethylene (PEX-AL-PEX) pressure pipe, chlorinated polyvinyl chloride (CPVC) or polybutylene with a minimum rating of 100 psi at 180°F (690 kPa at 82°C).

7103.2 Piping Joints. Piping joints that are embedded shall be installed in accordance with the following requirements:

1. Steel pipe joints shall be welded.
2. Copper tubing shall be joined with brazing material having a melting point exceeding 1,000°F (538°C).
3. Polybutylene pipe and tubing joints shall be

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installed with socket-type, heat-fused polybutylene fittings.

4. CPVC tubing shall be joined using solvent cement joints.

7103.3 Testing. Piping or tubing to be embedded shall be tested by applying a hydrostatic pressure of not less than 100 psi (690 kPa). The pressure shall be maintained for 30 minutes, during which all joints shall be visually inspected for leaks.

**780 CMR TABLE 7101.2
HYDRONIC PIPING MATERIALS**

MATERIAL	USE CODE ^a	STANDARD ^b	JOINTS	NOTES
Brass pipe	1	ASTM B 43	Brazed, welded, threaded, mechanical and flanged fittings	
Brass tubing	1	ASTM B 135	Brazed, soldered and mechanical fittings	
Chlorinated poly (vinyl chloride) (CPVC) pipe and tubing	1, 2, 3	ASTM D 2846	Solvent cement joints, compression joints and threaded adapters	
Copper pipe	1	ASTM B 42, B 302	Brazed, soldered and mechanical fittings threaded, welded and flanged	
Copper tubing (type K, L or M)	1, 2	ASTM B 75, B 88, B 251, B 306	Brazed, soldered and flared mechanical fittings	Joints embedded in concrete
Cross-linked polyethylene (PEX) tubing	2, 3	ASTM F 876, F 877	Mechanical compression	Install in accordance with manufacturer's instructions.
Cross-linked polyethylene/ aluminum/ cross-linked polyethylene- (PEX-AL-PEX) pressure pipe	1, 2	ASTM F 1281 or CAN/CSA B 137.10	Mechanical, crimp/insert	Install in accordance with manufacturer's instructions.
Plastic fittings PEX		ASTM F 1807		
Polybutylene (PB) pipe and tubing	1, 2, 3	ASTM D 3309	Heat-fusion, crimp/insert and compression	Joints in concrete shall be heat-fused.
Polyethylene (PE) pipe, tubing and fittings (for ground source heat pump loop systems)	1, 2, 4	ASTM D 2513; ASTM D 3350; ASTM D 2513; ASTM D 3035; ASTM D 2447; ASTM D 2683; ASTM F 1055; ASTM D 2837; ASTM D 3350; ASTM D 1693	Heat-fusion	
Soldering fluxes	1	ASTM B 813	Copper tube joints	
Steel pipe	1, 2	ASTM A 53; A 106	Brazed, welded, threaded, flanged and mechanical fittings	Joints in concrete shall be welded. Galvanized pipe shall not be welded or brazed.
Steel tubing	1	ASTM A 254	Mechanical fittings, welded	

For SI: °C = [(°F) - 32]/1.8.

a. Use code:

1. Above ground.
2. Embedded in radiant system.
3. Temperatures below 180°F only.
4. Low temperature (below 130°F) applications only.

b. Standards as listed in 780 CMR 100.00.

**780 CMR TABLE 7101.10
HANGER SPACING INTERNALS**

PIPING MATERIAL	MAXIMUM HORIZONTAL SPACING (feet)	MAXIMUM VERTICAL SPACING (feet)
ABS	4	10
CPVC = 1 inch pipe or tubing	3	5
CPVC = 1¼ inch	4	10
Copper or copper alloy pipe	12	10
Copper or copper alloy tubing	6	10
PB pipe or tubing	2.67	4
PE pipe or tubing	2.67	4
PEX tubing	2.67	4
PVC	4	10
Steel pipe	12	15
Steel tubing	8	10

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

780 CMR 7104 LOW TEMPERATURE PIPING

7104.1 Piping Materials. Low temperature piping for embedment in concrete shall be as indicated in 780CMR Table 7101.2.

7104.2 Piping Joints. Pipe joints (other than those in 780 CMR 7103.2) that are embedded shall be installed in accordance with the following requirements:

1. Cross-linked Polyethylene (PEX) tubing shall follow manufacturer's instructions.
2. Polyethylene tubing shall be installed with heat fusion joints.

7104.2.1 Polyethylene Plastic Pipe and Tubing for Ground Source Heat Pump Loop Systems. Joints between polyethylene plastic pipe and tubing or fittings for ground source heat pump loop systems shall be heat fusion joints conforming to 780 CMR 7104.2.1.1, electrofusion joints conforming to 780 CMR 7104.2.1.2 or stab-type insertion joints conforming to 780 CMR 7104.2.1.3.

7104.2.1.1 Heat-fusion Joints. Joints shall be of the socket-fusion, saddle-fusion or butt-fusion type, fabricated in accordance with the piping manufacturer's instructions. Joint surfaces shall be clean and free of moisture. Joint surfaces shall be heated to melt temperatures and joined. The joint shall be undisturbed until cool. Fittings shall be

manufactured in accordance with ASTM D 2683.

7104.2.1.2 Electrofusion Joints. Joints shall be of the electrofusion type. Joint surfaces shall be clean and free of moisture, and scoured to expose virgin resin. Joint surfaces shall be heated to melt temperatures for the period of time specified by the manufacturer. The joint shall be undisturbed until cool. Fittings shall be manufactured in accordance with ASTM F 1055.

7104.2.1.3 Stab-type Insert Fittings. Joint surfaces shall be clean and free of moisture. Pipe ends shall be chamfered and inserted into the fitting to full depth. Fittings shall be manufactured in accordance with ASTM D2513.

780 CMR 7105 GROUND SOURCE HEAT PUMP SYSTEM LOOP PIPING

7105.1 Testing. The assembled loop system shall be pressure-tested with water at 100 psi (690 kPa) for 30 minutes with no observed leaks before connection (header) trenches are backfilled. Flow rates and pressure drops shall be compared to calculated values. If actual flow rate or pressure drop figures differ from calculated values by more than 10%, the problem shall be identified and corrected.

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SPECIAL PIPING AND STORAGE SYSTEMS

780 CMR 7201 OIL TANKS

7201.1 Jurisdiction. *For requirements governing the design, installation, maintenance, testing and/or removal of above-ground oil tanks; in-building oil tanks and underground oil tanks, see 527 CMR.*

7201.2 flood-resistant Installation. In areas prone to flooding as established by the community flood insurance rate map, tanks shall be installed at or above the design flood elevation established in 780 CMR 5323 or shall be anchored to prevent flotation, collapse and lateral movement under conditions of the design flood.

780 CMR 7202 OIL PIPING, FITTING AND CONNECTIONS

7202.1 Jurisdiction. *For requirements governing oil piping fittings and connections, see 527 CMR.*

780 CMR 7203 INSTALLATION

7203.1 Jurisdiction. *For requirements governing the installation of oil piping, see 527 CMR.*

7203.2 Vent Termination. Vent piping shall terminate outside of buildings at a point not less than two feet (610 mm), measured vertically or horizontally, from any building opening. Outer ends of vent piping shall terminate in a weatherproof cap or fitting having an unobstructed area at least equal to the cross-sectional area of the vent pipe, and shall be located sufficiently above the ground to avoid being obstructed with snow and ice.

780 CMR 7204 OIL PUMPS AND VALVES SERVING HEATING APPLIANCES

7204.1 Jurisdiction. *For requirements governing oil pumps and safety devices associated with oil-fired appliances, see 527 CMR.*

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SOLAR SYSTEMS

780 CMR 7301 SOLAR ENERGY SYSTEMS

7301.1 General. 780 CMR 7301 provides for the design, construction, installation, alteration, and repair of equipment and systems utilizing solar energy to provide space heating or cooling, hot water heating, and swimming pool heating.

7301.2 Installation. Installation of solar energy systems shall comply with 780 CMR 7301.2.1 through 7301.2.9.

7301.2.1 Access. Solar energy collectors, controls, dampers, fans, blowers and pumps shall be accessible for inspection, maintenance, repair and replacement.

7301.2.2 Roof-mounted Collectors. The roof shall be constructed to support the loads imposed by roof-mounted solar collectors. Roof-mounted solar collectors that serve as a roof covering shall conform to the requirements for roof coverings in 780 CMR 59.00. Where mounted on or above the roof coverings, the collectors and supporting structure shall be constructed of noncombustible materials or fire-retardant-treated wood equivalent to that required for the roof construction.

7301.2.3 Pressure and Temperature Relief. System components containing fluids shall be protected with pressure-and temperature-relief valves. Relief devices shall be installed in sections of the system so that a section cannot be valved off or isolated from a relief device. *Where applicable, the pressure and temperature relief requirements of 522 CMR shall apply.*

7301.2.4 Vacuum Relief. System components that might be subjected to pressure drops below atmospheric pressure during operation or shutdown shall be protected by a vacuum-relief valve. *Where applicable, the vacuum relief requirements of 522 CMR shall apply.*

7301.2.5 Protection from Freezing. System components shall be protected from damage resulting from freezing of heat-transfer liquids utilized. Freeze protection shall be provided by heating, insulation, thermal mass and heat transfer fluids with freeze points lower than the winter design temperature, heat tape or other approved methods, or combinations thereof.

7301.2.6 Expansion Tanks. Expansion tanks in solar energy systems shall be installed in accordance with 780 CMR 70.00 in closed fluid loops that contain heat transfer fluid. *Where applicable, the pressure and temperature relief requirements of 522 CMR shall apply.*

7301.2.7 Roof and Wall Penetrations. Roof and

wall penetrations shall be flashed and sealed to prevent entry of water, rodents and insects in accordance with 780 CMR 59.00.

7301.2.8 Solar Loop Isolation. Valves shall be installed to allow the solar collectors to be isolated from the remainder of the system. Each isolation valve shall be labeled with the open and closed position.

7301.2.9 Maximum Temperature Limitation. Systems shall be equipped with means to limit the maximum water temperature of the system fluid entering or exchanging heat with any pressurized vessel inside the dwelling to 180°F (82°C). This protection is in addition to the required temperature-and pressure-relief valves required by 780 CMR 7301.2.3.

7301.3 Labeling. Labeling shall comply with 780 CMR 7301.3.1 and 7301.3.2. *Where applicable, the labeling requirements of 522 CMR shall apply.*

7301.3.1 Collectors. Collectors shall be listed and labeled to show the manufacturer's name, model number, serial number, collector weight, collector maximum allowable temperatures and pressures, and the type of heat transfer fluids that are compatible with the collector. The label shall clarify that these specifications apply only to the collector. *Where solar systems are custom built by the homeowner or agent and are not a manufacturer's packaged system, the requirement still exists that any pressure vessels be labeled in accordance with the requirements of 522 CMR and otherwise the collector labeling requirements relative to collector maximum allowable temperatures and pressures, and the type of heat transfer fluids that are compatible with the collector shall be provided by label or in the form of a report to the Building Department as part of the building permit requirements (such report may include reference to recognized plans utilized to construct such collectors or may consist of a report from a qualified Massachusetts professional engineer).*

7301.3.2 Thermal Storage Units. Pressurized thermal storage units shall be listed and labeled to show the manufacturer's name, model number, serial number, storage unit maximum and minimum allowable operating temperatures and pressures, and the type of heat transfer fluids that are compatible with the storage unit. The label shall clarify that these specifications apply only to the thermal storage unit. *Where thermal storage units are custom built by the homeowner or*

agent and are not a manufacturer's packaged system, the requirement still exists that any pressure vessels be labeled in accordance with the requirements of 522 CMR and otherwise the thermal storage unit labeling requirements relative to storage unit maximum and minimum allowable operating temperatures and pressures, and the type of heat transfer fluids that are compatible with the storage unit shall be provided in the form of a report to the Building Department as part of the building permit requirements (such report may include reference

to recognized plans utilized to construct such collectors or may consist of a report from a qualified Massachusetts professional engineer).

7301.4 Prohibited Heat Transfer Fluids. Flammable gases and liquids shall not be used as heat transfer fluids.

7301.5 Backflow Protection. All connections from the potable water supply to solar systems shall comply with applicable requirements of 310 CMR.

780 CMR 74.00

FUEL GAS

780 CMR 7401 JURISDICTION

7401.1 *Fuel Gas and Plumbing Code.* The “Fuel Gas and Plumbing Code” in Massachusetts is 248 CMR.

NON-TEXT PAGE

780 CMR 75.00

PLUMBING ADMINISTRATION

780 CMR 7501 JURISDICTION

7501.1 Fuel Gas and Plumbing Code. The “Fuel Gas and Plumbing Code” in Massachusetts is 248 CMR.

NON-TEXT PAGE

GENERAL PLUMBING REQUIREMENTS

780 CMR 7601 JURISDICTION

7601.1 Fuel Gas and Plumbing Code. *The "Fuel Gas and Plumbing Code" in Massachusetts is 248 CMR; otherwise the structural and piping protection requirements of 780 CMR 7602 apply.*

4780 CMR 7602 STRUCTURAL AND PIPING PROTECTION

7602.1 General. In the process of installing or repairing any part of a plumbing and drainage installation, the finished floors, walls, ceilings, tile work or any other part of the building or premises that must be changed or replaced shall be left in a safe structural condition in accordance with the requirements of the building portion of 780 CMR 51.00 through 99.00

7602.2 Drilling and Notching. Wood-framed structural members shall not be drilled, notched or altered in any manner except as provided in 780 CMR 7502.6, 7602.5, 7602.6.

7602.2.1 Protection against Physical Damage. In concealed locations, where piping, other than cast-iron or galvanized steel, is installed through holes or notches in studs, joists, rafters or similar members less than 1.5 inches (38 mm) from the nearest edge of the member, the pipe shall be protected by shield plates. Protective shield plates shall be a minimum of 0.062-inch-thick (1.6 mm) steel, shall cover the area of the pipe where the

member is notched or bored and shall extend a minimum of two inches (51 mm) above sole plates and below top plates.

7602.3 Breakage and Corrosion. Pipes passing through or under walls shall be protected from breakage. Pipes passing through concrete or cinder walls and floors, cold-formed steel framing or other corrosive material shall be protected against external corrosion by a protective sheathing or wrapping or other means that will withstand any reaction from lime and acid of concrete, cinder or other corrosive material. Sheathing or wrapping shall allow for expansion and contraction of piping to prevent any rubbing action. Minimum wall thickness of material shall be 0.025 inch (0.64 mm).

7602.4 Sleeves. Annular spaces between sleeves and pipes shall be filled or tightly caulked as approved by the building official. Annular spaces between sleeves and pipes in fire-rated assemblies shall be filled or tightly caulked in accordance with this the building portion of 780 CMR 51.00 through 59.00.

7602.5 Pipes through Footings or Foundation Walls. Any pipe that passes under a footing or through a foundation wall shall be provided with a relieving arch; or there shall be built into the masonry wall a pipe sleeve two pipe sizes greater than the pipe passing through.

NON-TEXT PAGE

780 CMR 77.00

PLUMBING FIXTURES

780 CMR 7701 JURISDICTION

7701.1 Fuel Gas and Plumbing Code. The "Fuel Gas and Plumbing Code" in Massachusetts is 248 CMR.

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780 CMR 78.00

WATER HEATERS

780 CMR 7801 JURISDICTION

7801.1 Fuel Gas and Plumbing Code. The "Fuel Gas and Plumbing Code" in Massachusetts is 248 CMR.

NON-TEXT PAGE

WATER SUPPLY AND DISTRIBUTION

780 CMR 7901 JURISDICTION

7901.1 Potable Water Requirements. The Fuel Gas and Plumbing Code. The "Fuel Gas and Plumbing Code" in Massachusetts is 248 CMR;

additionally, water protection and backflow prevention requirements are found in 310 CMR and/or local private/public water purveyor requirements.

NON-TEXT PAGE

780 CMR 80.00

SANITARY DRAINAGE

780 CMR 8001 JURISDICTION

8001.1 Fuel Gas and Plumbing Code. The "Fuel Gas and Plumbing Code" in Massachusetts is 248 CMR.

NON-TEXT PAGE

780 CMR 81.00

VENTS

780 CMR 8101 JURISDICTION

8101.1 Fuel Gas and Plumbing Code. The "Fuel Gas and Plumbing Code" in Massachusetts is 248 CMR.

NON-TEXT PAGE

780 CMR 82.00

TRAPS

780 CMR 8201 JURISDICTION

8201.1 Fuel Gas and Plumbing Code. The "Fuel Gas and Plumbing Code" in Massachusetts is 248 CMR.

NON-TEXT PAGE

780 CMR 83.00

GENERAL REQUIREMENTS

780 CMR 8301 JURISDICTION

8301.1 Electrical Code. *The “Electrical Code” in Massachusetts is 527 CMR 12.00, but building structure protection and fire-resistance requirements are found in 780 CMR 8302.*

780 CMR 8302 BUILDING STRUCTURE PROTECTION

8302.1 Drilling and Notching. Wood-framed structural members shall not be drilled, notched or altered in any manner except as provided in 780 CMR 55.00 through 58.00, and as applicable.

8302.2 Penetrations of Fire-resistance-rated Assemblies. Electrical installations in hollow spaces, vertical shafts, and ventilation or

air-handling ducts shall be made so that the possible spread of fire or products of combustion will not be substantially increased. Electrical penetrations through fire-resistance-rated walls, partitions, floors or ceilings shall be protected by approved methods to maintain the fire-resistance rating of the element penetrated. Penetrations of fire-resistance-rated walls shall be limited as specified in 780 CMR 5317.3.

8302.3 Penetrations of Firestops and Draftstops. Penetrations through fire blocking and draftstopping shall be protected in an approved manner to maintain the integrity of the element penetrated

NON-TEXT PAGE

780 CMR 84.00

ELECTRICAL DEFINITIONS

780 CMR 8401 JURISDICTION

8401.1 Electrical Code. The "Electrical Code" in Massachusetts is 527 CMR 12.00.

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780 CMR 85.00

SERVICES

780 CMR 8501 JURISDICTION

8501.1 Electrical Code. The "Electrical Code" in Massachusetts is 527 CMR 12.00.

780 CMR 8502 GROUNDING

8502.1 Foundation Grounding. Where footing/foundation systems of one- and two-family buildings contain steel reinforcing, conformance to 527 CMR 12.00 grounding criteria is required.

NON-TEXT PAGE

780 CMR 86.00

BRANCH CIRCUIT AND FEEDER REQUIREMENTS

780 CMR 8601 JURISDICTION

***8601.1 Electrical Code. The "Electrical Code" in
Massachusetts is 527 CMR 12.00.***

NON-TEXT PAGE

780 CMR 87.00

WIRING METHODS

780 CMR 8701 JURISDICTION

***8701.1 Electrical Code. The "Electrical Code" in
Massachusetts is 527 CMR 12.00.***

NON-TEXT PAGE

780 CMR 88.00

POWER AND LIGHTING DISTRIBUTION

780 CMR 8801 JURISDICTION

8801.1 Electrical Code. The "Electrical Code" in Massachusetts is 527 CMR 12.00.

780 CMR 8802 ENERGY CONSERVATION

8802.1 Energy Code. For energy conservation requirements associated with power and lighting, see 780 CMR 61.00, as applicable

NON-TEXT PAGE

780 CMR 89.00

DEVICES AND LUMINAIRES

780 CMR 8901 JURISDICTION

8901.1 Electrical Code. The "Electrical Code" in Massachusetts is 527 CMR 12.00.

780 CMR 8902 ENERGY CONSERVATION

8902.1 Energy Code. For energy conservation requirements associated with power and lighting, see 780 CMR 61.00, as applicable

NON-TEXT PAGE

780 CMR 90.00

APPLIANCE INSTALLATION

780 CMR 9001 JURISDICTION

9001.1 Electrical Code. The "Electrical Code" in Massachusetts is 527 CMR 12.00.

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780 CMR 91.00

SWIMMING POOLS (*Electrical Requirements*)

780 CMR 9001 JURISDICTION

9101.1 Swimming Pool Requirements. Refer to 780 CMR Appendix 120.2, but note that for all electrical requirements, see the Electrical Code in Massachusetts, 527 CMR 12.00.

NON-TEXT PAGE

780 CMR 92.00

**CLASS 2 REMOTE-CONTROL, SIGNALING
AND POWER-LIMITED CIRCUITS**

780 CMR 9201 JURISDICTION

***9201.1 Electrical Code. The "Electrical Code" in
Massachusetts is 527 CMR 12.00.***

NON-TEXT PAGE

780 CMR 93.00

REPAIR, RENOVATION, ALTERATION, ADDITION, DEMOLITION AND CHANGE OF USE OF EXISTING ONE- AND TWO-FAMILY DWELLINGS

(Note: 780 CMR 93.00 is Unique to Massachusetts)

780 9301 SCOPE

9301.1 Scope. The provisions of 780 CMR 9301 govern the repair, renovation, alteration, additions, change in use and demolition of existing one and two family detached dwellings and accessory buildings and structures which were legally constructed under 780 CMR 51.00 through 99.00 or prior editions of the *Massachusetts State Building Code* or other legally adopted codes, laws, bylaws or regulations adopted by the jurisdiction and which were in effect at the time the existing building was constructed, renovated or otherwise altered.

9301.2 Intent. The intent of 780 CMR 9301 is to provide for standards of construction which serve to maintain or improve the performance of existing buildings and to permit existing buildings and components of existing buildings to remain in use without necessarily requiring compliance with the code for new construction unless expressly required otherwise.

9301.3 Compliance Alternatives. Where compliance with the provisions of 780 CMR 51.00 through 99.00 for new construction is required and where such compliance is impractical because of structural, construction issues or regulatory conflicts, compliance alternatives may be accepted by the building official.

9301.3.1 Documentation of Compliance Alternatives. In accordance with 780 CMR 9302.5, the building official shall ensure that the BBRS is provided with information regarding compliance alternatives accepted or rejected by the building official.

9301.4 Buildings which Qualify. The provisions of 780 CMR 93.00 shall apply to existing buildings which have been legally occupied and/or used for a period of at least five years. Any building for which there exists an outstanding notice of violation or other order of the building official shall not qualify to use 780 CMR 93.00 unless such proposed work includes the abatement of all outstanding violations and compliance with all outstanding orders of the building official. Buildings which do not qualify as existing buildings for the purposes of 780 CMR 93.00 shall comply fully with the applicable provisions of 780 CMR 51.00 through 99.00 for new construction.

9301.5 Specialized Codes. Nothing in 780 CMR

9301.5 shall be deemed to regulate subject areas which are regulated by the Massachusetts Specialized Codes promulgated by the various specialized Boards established and authorized by Massachusetts General Law. Such specialized codes include but are not limited to:

1. 105 CMR
2. 248 CMR
3. 310 CMR
4. 521 CMR
5. 522 CMR
6. 527 CMR
7. 528 CMR

780 CMR 9302 DEFINITIONS

ADDITION. The creation of new building area(s) connected to the existing building. This definition shall also include the addition of a deck or platform, balcony or similar structure.

ALTERATION. The reconfiguration of existing spaces, including relocation of existing walls and/or the creation of rooms or spaces within the physical confines of the existing building. Alteration may include elements of demolition.

COMPLIANCE ALTERNATIVE. An alternative life safety construction feature which meets or exceeds the requirements or intent of a specific provision of 780 CMR. The building official is authorized to approve or disapprove compliance alternatives. Compliance alternatives are only permitted for existing buildings.

DEMOLITION. The removal or dismantling of existing construction, in whole or in part, with or without the intent to replace the construction so affected.

EXISTING BUILDING. A one- or two-family dwelling which has been issued a valid certificate of use and occupancy or has been occupied legally for a period of five years. An existing building which is occupied for less than this period shall be subject to provisions of 780 CMR 51.00 through 99.00 for new construction.

EXISTING NONCONFORMING. The building, room, space or any feature or element which does not conform with the current requirements of 780 CMR 51.00 through 99.00 for new construction.

LATENT CONDITIONS. Deleterious conditions which existed prior to alterations, additions or change in use but are not evident until after the start of construction, renovation or demolition.

REPAIR/RENOVATION. The reconstruction or renewal of any part of an existing building for the purpose of its maintenance without altering the physical layout of the space or spaces within the existing building.

REPAIR (Ordinary). Any maintenance which does not affect structure, egress, fire protection systems, fire ratings, energy conservation provisions, plumbing, sanitary, gas, electrical or other utilities.

SERVICEABLE. A building feature, component or system which, by virtue of its physical condition, is suitable to continue in service without having a deleterious effect on the normal or intended use of the building or on the safety of the occupants or on the public safety.

UNSERVICEABLE. A building feature, component or system which, by virtue of its physical condition is unsuitable to remain in service.

Terms not Defined. Terms not defined in 780 CMR 9302 shall be as defined in 780 CMR 52.00.

780 CMR 9303 GENERAL REQUIREMENTS

9303.1 Classification of Work. Work on an existing building shall be classified in one or more of the categories listed below and as defined in 780 CMR 9303.

1. Repair or renovation
2. Alteration(s)
3. Addition(s)
4. Demolition (partial or total)

9303.1.1 Repair or Renovation Shall Comply with 780 CMR 9304 and 9306 When Applicable.

9303.1.2 Alterations Shall Comply with 780 CMR 9304 and 9305 and 9306 When Applicable.

9303.1.3 Additions shall Comply with 780 CMR 9304 and 9306.

9303.1.4 Energy Conservation Requirements Shall Comply with 780 CMR 9307.

9303.2 Building permit Requirements.

9303.2.1 Building Permit Requirements. A building permit shall be required for all categories of work in 780 CMR 93.00 except that a permit shall not be required for ordinary repairs as defined in 780 CMR 9302: REPAIR (Ordinary).

9303.2.2 Application. A building permit application shall be filed in accordance with 780 CMR 5110 and 780 CMR 93.00 and a building permit shall be obtained prior to the start

of work for any category of work proposed under 780 CMR 93.00 except no permit shall be required for ordinary repairs.

9303.3 Certificate of Use and Occupancy. At the completion of work the permit applicant shall apply for a certificate of use and occupancy in accordance with 780 CMR 5120.

9303.4 Unlined Chimneys. Where new HVAC appliances are connected to an unlined chimney, the chimney lining requirements of 248 CMR or 527 CMR, as applicable, and those of the appliance manufacturer shall be satisfied. If the appliance is a solid fuel-burning appliance, the chimney shall be relined to satisfy requirements both of the code for new construction and those of the manufacturer, as applicable.

9303.5 Power Venters. The requirements of 248 CMR or 527 CMR shall apply as applicable. If the appliance is a solid fuel-burning appliance, any power venter utilized shall be listed for the application, as shall the solid fuel-burning appliance, sized for the appliance being exhausted, contain required pressure proving switching, and be installed relative to combustible construction in accordance with the power venter listing; likewise, power venter requirements of the solid fuel-burning appliance manufacturer shall apply, as applicable and if power venting is not allowed by the solid fuel-burning appliance manufacturer, then power venting shall not be allowed.

9303.6 Flood-resistant Construction for Existing Buildings. When applicable, conformance to 780 CMR 5323 is required (also see 780 CMR 9306).

780 CMR 9304 REPAIRS AND RENOVATIONS

9304.1 Repairs and Renovations. Repairs or renovations to existing buildings which maintain or improve the performance of the building may be made with the same or like materials, unless required otherwise by 780 CMR 51.00 through 99.00. Alterations or repairs which have the effect of replacing a building system as a whole, or the repair or replacement, or installation of interior finishes, or structural elements or systems shall comply with 780 CMR 51.00 through 99.00 for new construction to the fullest extent practicable.

9304.2 New Building Systems. Any new building system or portion thereof shall conform to 780 CMR for new construction to the fullest extent practicable. However, individual components of an existing building system may be repaired or replaced without requiring that system to comply fully with the code for new construction unless specifically required by 780 CMR 93.00.

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9304.3 Existing Nonconforming Buildings, Spaces, Rooms, Building Systems or Building Components. Features of existing construction including but not limited to stairs, guardrails or ceiling heights which do not meet the requirements of 780 CMR 51.00 through 99.00 for new construction shall be presumed to have met the regulations, codes or laws in effect at the time of construction or alteration and, if so, shall be deemed to be existing nonconforming. Unless stated otherwise, nothing in 780 CMR 9304 shall require the upgrading or replacement of any existing nonconforming features or component of an existing building, provided the feature(s) or components or systems are in a serviceable condition unless the building official determines that an unsafe or dangerous condition would exist, in which case he shall order the remediation of such condition. Nor shall 780 CMR 9304 be deemed to require the replacement or upgrading of serviceable components which are not included in the scope of work for which a permit is applied unless expressly required by other sections of 780 CMR 51.00 through 99.00, or unless the building official determines that an unsafe or dangerous condition would result.

Exception: Existing components or features of an existing building which, in the opinion of the building official, are dangerous, unsafe, un-serviceable or demonstrate damage or significant deterioration or which otherwise present a threat to the occupants or to the public safety shall be remediated in accordance with the applicable sections of 780 CMR 51.00 through 99.00.

9304.4 Roofing, Reroofing and Flashing.

9304.4.1 General. Materials and methods used for repair, replacement or recovering an existing roof shall comply with 780 CMR 59.00 and applicable sections of 780 CMR 93.00. When the repair, replacement or recovering within any 12-month period exceeds 25% of the roof covering of the building, the entire roof covering shall comply with the requirements for new roofing.

9304.4.2 Roof Covering Installation. Roof covering installation methods, materials and flashings shall comply with 780 CMR 59.00, as applicable, and in accordance with manufacturer's written installation instructions. Where manufacturer's installation instructions differ from the requirements of 780 CMR 51.00 through 99.00, printed manufacturer's instructions shall govern warranties relative to roof covering.

9304.4.3 Recovering Versus Replacement. New roof coverings shall not be installed without first removing existing roof coverings when any of the following conditions occur:

1. When the existing roof or roof covering is water soaked or deteriorated to the point of being unacceptable as a base for additional

roofing.

2. When the existing roof covering is wood shake, slate, clay or cement tile; except when the new roof covering is installed in accordance with approved industry standards.

3. When the existing roof has two or more layers of any type of roofing.

Exception. The removal of existing roof coverings shall not be required where complete and separate roofing systems are provided which transmit all roof loads directly to the structural system of the building and which do not bear upon the existing roof.

9304.4.4 Reinstallation of Roofing Materials.

The reinstallation of existing roof covering materials which have been removed is not permitted.

9304.4.5 Flashings. Flashings shall be reconstructed in accordance with approved manufacturer's instructions and 780 CMR 51.00 through 99.00.

9304.4.6 Structural and Construction Loads.

The existing roof system shall be capable of supporting all equipment loads encountered during installation as well as the loads resulting from the new roofing materials.

9304.5 Replacement Windows.

9304.5.1 Structural Requirements. Where windows are replaced which require enlargement of the existing opening, an adequately sized structural header, jack studs and other necessary framing shall be installed.

9304.5.2 Emergency Egress Windows. All emergency escape windows from sleeping rooms shall have a net clear opening of 3.3 square feet (0.307 m²). The minimum net clear opening shall be 20 inches by 24 inches (508 mm by 610 mm) in either direction except that windows in sleeping rooms of existing dwellings which do not conform to these requirements may be replaced without conforming to these dimensional requirements, provided that the windows do not significantly reduce the existing opening size.

Exception: Replacement windows utilized as emergency egress windows, other than double-hung windows, shall generally conform to the requirements of 780 CMR 5310.1.1 without conforming to the cited dimensional requirements, provided that such replacement windows do not significantly reduce the existing opening size.

9304.5.3 Safety Glazing. Safety glazing shall be used in specific hazardous locations where identified in 780 CMR 5308.4.

9304.5.4 Replacement Window Energy Conservation Performance. See 780 CMR 9307.

9304.6 Exterior Wall Coverings. Exterior wall coverings shall be installed in accordance with the provisions of 780 CMR 51.00 through 99.00 for new construction and in accordance with manufacturers printed instructions.

9304.6.1 Flashing Details. Proper flashing shall be incorporated commensurate with the exterior wall covering type.

9304.7 Latent Conditions. When latent conditions are observed and which are determined by the licensed construction supervisor, the owner or the building official to be dangerous or unsafe, or when a component or system is determined to be unserviceable, said conditions shall be corrected in accordance with applicable provisions of 780 CMR 51.00 through 99.00. A building permit shall be obtained or the building permit shall be amended in accordance with the provisions of 780 CMR 5110 in order to reflect the necessary required work and the approval shall be obtained from the building official prior to commencement of the corrections.

Exception: If the public safety so warrants, the corrective actions are permitted to be made prior to amending the building permit application, providing that the building official is notified in writing within 24 hours of actions taken pursuant to this exception. This exception shall not be construed as to authorize constructive approval nor set aside the requirements to amend the permit application, nor shall the authority of the building official to enforce 780 CMR 51.00 through 99.00 be abridged. Such corrective actions shall be documented by the construction supervisor or the owner and submitted to the building official within 48 hours of the completion of the action under this exception. Such corrective work shall not be concealed until the building official has inspected and approved the work.

9304.8 Smoke Heat Detection and Carbon Monoxide Alarm Systems and CO Detection and Alarm. When one or more sleeping rooms are added or created in existing dwellings, the entire existing building shall be provided with smoke detectors, heat detector and carbon monoxide detectors designed, located and installed in accordance with the provisions for new construction, 780 CMR 5313, as applicable.

If a garage is created under an existing dwelling or attached to an existing dwelling, a heat detector, conforming to the requirements of the code for new construction shall be installed in the garage; such requirement is not applicable for detached garages (see 780 CMR 5313.2).

If the dwelling undergoes complete reconstruction such that all walls and ceilings are open to framing,

then the entire existing building shall be provided with smoke detectors, heat detector and carbon monoxide detectors designed, located and installed in accordance with the provisions for new construction (see 780 CMR 5313 inclusive and as applicable).

In an existing two-family dwelling, if one or more sleeping rooms are added or created in only one of the two dwelling units, the dwelling unit acquiring new sleeping rooms shall be provided with smoke detectors, heat detector and carbon monoxide detectors, as applicable, designed, located and installed in accordance with the provisions for new construction.

In an existing two-family dwelling, if, during a repair/reconstruction event, one or more sleeping rooms are added or created in both of the two dwelling units, the entire building shall be provided with smoke detectors, heat detector and carbon monoxide detectors, as applicable, designed, located and installed in accordance with the provisions for new construction for two-family buildings.

Note: CO detector requirements for existing R-4 uses are also governed by 527 CMR 31.00 and 248 CMR.

9304.9 Energy Conservation Requirements. Energy conservation requirements shall comply with 780 CMR 9307.

780 CMR 9305 ALTERATION OF EXISTING SPACES

9305.1 General Requirements. Alterations shall meet the requirements of 780 CMR 9304, as applicable, and the requirements of 780 CMR 9305.1. All new rooms or spaces created by remodeling existing spaces and the access and egress to and from such spaces, including emergency egress when required, shall meet the minimum requirements of 780 CMR 51.00 through 99.00 for new construction to the fullest extend practicable and shall be provided with light and ventilation in accordance with the provisions for new construction.

Exceptions: Notwithstanding contrary requirements of 780 CMR 51.00 through 99.00, the following are permitted in existing construction:

1. All interior door widths except bathrooms, 28 inches (711 mm) minimum
2. Bathroom door widths 24 inches (610 mm) minimum
3. Other than the two required means of egress doors, additional, nonrequired exterior doors and sliders shall be permitted at widths and heights less than required for required means of egress exterior doorways and that in the opinion of the building official are otherwise acceptable in width.
4. Ceiling heights shall be permitted to match existing ceiling heights.

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5. Ceiling heights in basement or cellar spaces shall be a minimum of six feet eight inches (2032 mm) but discrete projections below ceilings in basement or cellar spaces due to structure and/or HVAC ductwork/piping shall be allowed to a minimum height of six feet six inches (1981 mm) if in the opinion of the building official such ceiling heights and projections are not unduly hazardous to the occupants.

9305.2 Interior Trim and Finish. All new interior finish and trim within the work area shall comply with the requirements of 780 CMR 51.00 through 99.00 for new construction, as applicable.

9305.3 Structural Requirements. If the remodeling or alteration results in additional dead, environmental or live loads as prescribed by 780 CMR 93.00, the existing structural system shall be investigated and, if necessary, strengthened to safely support the additional loads, prior to any remodeling or alteration that would impose such loading. When applicable, fenestration shall conform to the wind-borne debris requirements of 780 CMR 53.00.

9305.4 Fire Protection Systems. Existing fire protection systems shall be permitted to remain without change, provided such systems are in a serviceable condition. See also 780 CMR 9304.8 if applicable to the reconstruction event.

Note: Also see M.G.L. c. 148, §§ 26B, 26E, 26F and 27A and 527 CMR as applicable.

9305.5 Existing Stairways, Stairs and Landings. Existing stairways, landings, handrails and guardrails are permitted to remain in service without modification unless such stairs, handrails or guardrails are structurally unsound or otherwise unsafe or unserviceable. If replaced, existing stairs may be reconstructed without necessarily requiring the stairway dimensions to be altered.

9305.5.1 Existing Handrails and Guardrails. If existing handrails and/or guardrails are totally replaced, such shall be replaced with handrail/guardrails complying with the code for new construction.

9305.6 Replacement Windows. See 780 CMR 9304.5.

9305.7 Energy Conservation Requirements. Energy conservation requirements shall comply with 780 CMR 9307.

9305.8 Additions to Existing Buildings.

9305.8.1 General. Vertical and horizontal additions to existing buildings shall comply with the code for new construction to the fullest extent practicable. Effects of the addition on the existing structural systems shall be evaluated and action

shall be taken where necessary to ensure that structural effects in the existing building caused by the addition are properly accounted for. Additions which have the effect of creating additional dead, live or drifted or sliding snow loads on the adjacent building shall cause the adjacent building to be evaluated and strengthened where necessary.

9305.8.2 Ingress and Egress. Existing doors, corridors and stairs or other egress component systems are permitted to be used to access an addition without requiring nonconforming elements to comply with the code for new construction unless, in the opinion of the building official, said ingress and egress components are unsafe.

Exception: Ceiling heights may be constructed to match existing ceiling heights where the ceiling height in the existing portion of the building do not comply with 780 CMR 51.00 through 99.00 for new construction but in no instance less than those prescribed in 780 CMR 9305.1, Exceptions 4. and 5.

9305.8.3 Chimneys. Vertical or horizontal additions which necessitate the extension of an existing chimney shall cause the existing chimney to comply with requirements for new construction to the fullest extent practicable.

9305.8.4 Fire Protection Systems. Existing fire protection systems shall be permitted to remain without change provided that the system is serviceable condition. For additions which result in the creation of additional sleeping rooms, see 780 CMR 9304.8.

9305.8.5 Energy Conservation Requirements. Energy conservation requirements shall comply with 780 CMR 9307.

780 CMR 9306 FLOOD PLAIN CONSTRUCTION

Additions to existing buildings or alterations to existing buildings shall comply with 780 CMR 5323.

Note: The total replacement of a foundation system in a flood zone shall be deemed to be the replacement of a building system and shall cause the structure to be elevated or otherwise floodproofed to the extent required for new construction in accordance with 780 CMR 5323 to the fullest extent practicable.

780 CMR 9307 ENERGY CONSERVATION PROVISIONS

9307.1 General. 780 CMR 9307 establishes the energy provisions for existing one- and two-family buildings. 780 CMR 9307 intends to capture opportunities to make incremental improvements in

energy conservation to the fullest extent practical during renovations of existing buildings, their mechanical systems, or portions thereof. In general, these provisions do not require destructive work to be performed in order to capture energy conservation improvements, but instead they intend to take advantage of opportunities that are presented during the normal course of work to an existing building.

9307.2 Compliance. Portions of a building envelope; heating, air-conditioning, or service water heating system; and equipment that is being replaced or modified shall comply with the applicable requirements of 780 CMR 9307 in one of three ways.

1. The individual components and systems of the existing building or portions thereof that are being replaced or modified shall comply with the applicable requirements of 780 CMR 9307 as provided below; or
2. The individual components and systems of the existing building or portions thereof that are being replaced or modified shall comply with the applicable requirements of 780 CMR 61.00; or
3. Where more than one component of the existing building is being replaced, an annual energy usage analysis may be performed to demonstrate that the energy consumption of the building as modified will not exceed what the building would consume if each modified component complied with the requirements of 780CMR 9307.2.1. Such analysis must be performed by a professional registered engineer or registered architect, and documentation shall demonstrate that the analysis used is consistent with ASHRAE calculation procedures and accepted engineering practices.

9307.3 Exempt Buildings. Refer to 780 CMR 6101.3.1 for exempt buildings.

9307.4 Low-rise Residential Building Requirements.

9307.4.1 Insulation Requirements.

9307.4.1.1 Walls. When envelope walls are exposed during the course of work, they must be insulated by completely filling the framing cavity (behind furred or framed surfaces) with insulation of least R-3 per inch. However, insulation greater than R- 19 is not required.

9307.4.1.2 Roof/Ceilings.

1. When enclosed ("cathedral") roof/ceiling assemblies are exposed during the course of work, either from the interior or exterior, they must be insulated to completely fill the cavity between framing members with insulation of at least R-3 per inch. Ventilation must meet the requirements of 780 CMR 5806, as applicable.
2. When attic spaces are insulated during the course of work, they must be insulated to

at least R-30. Ventilation must meet the requirements of 780 CMR 5806, as applicable.

9307.4.1.3 Floor Assemblies. When floor assemblies that are part of the envelope are insulated during the course of work, they must be insulated to at least R- 19.

9307.4.1.4 Slab Floors. When slab floors that are part of the envelope are exposed during the course of work, they must be insulated to at least R-5.

Exception: Perimeter and slab insulation are not required if destructive work, beyond the scope of the proposed alteration, is necessary to provide them.

9307.5 Moisture Control and Air Leakage.

9307.5.1 Moisture Control. When new insulation is installed under the requirements of 780 CMR 9307, vapor retarders per 780 CMR 6106.2.1 shall be provided.

9307.5.2 Fenestration and Doors. New fenestration and new exterior doors shall meet the requirements of 780 CMR 6106.3.2. Existing exterior doors, when re-used, shall be equipped with weather seals and any newly installed interior doors or scuttles separating an unconditioned space (attics, attached garages) from conditioned space, likewise shall be equipped with weather seals and satisfy applicable requirements of 780 CMR 6106.3.2.

9307.5.3 Envelope Gaps and Cavities. All gaps and cavities between rough framing and door and window heads, jambs and sills exposed during the course of work shall be made air tight, filled with insulation and covered with a vapor retarder (also see 780 CMR 6106.2). Sealing materials spanning joints between construction materials shall allow for expansion and contraction of the construction materials. All new penetrations through the building envelope shall be made air tight.

9307.5.4 Fenestration. (Also see 780 CMR 9304.5.1)

9307.5.4.1 Windows, Skylights. and glass doors. When replacing existing glazed fenestration or adding new glazed fenestration to the envelope, the maximum allowable U-value shall be 0.44, and products shall be NFRC listed/labeled.

Exceptions:

1. In the repair of broken windows, broken doors or broken skylights, like-kind replacement shall be allowed, but the complete replacement of windows, doors or skylights in an existing building shall require compliance with the applicable requirements of 780 CMR 9307.6.3 and 9307.6.4

2. Criteria for NFRC listing/labeling and maximum U-0.44 are not required if the existing window(s) are true divided light (i.e., single thickness multipane sashes with structural muntin bars) and being replaced with "like kind" units. This exception additionally requires that a storm window be installed over the replacement window. The storm window may be installed internally, externally or integrated with the primary window.
3. Criteria for NFRC listing/labeling and maximum U-0.44 are not required for basement windows with a unit height up to 24 inches (610 mm), whether or not the basement is a conditioned space.

780 CMR 9308 MOVED STRUCTURES

9308.1 General. Moved structures are permitted to be re-used at a different site, provided that all new work associated with moving the structure and making the structure habitable shall comply with the code for new construction to the fullest extent practicable.

780 CMR 9309 HISTORIC BUILDINGS

9309.1 Scope. The provisions of 780 CMR 9309.0 shall govern all buildings and structures in the Commonwealth which are legally designated as historic buildings. 780 CMR 9309.0 shall preempt all other regulations of 780 CMR governing the reconstruction, alterations, change of use and occupancy, repairs, maintenance and additions for the conformity of historic buildings and structures to 780 CMR, with the exception of 780 CMR 5110 and 5111 for permitting and 780 CMR 5122.0 for appeals, or unless otherwise specified (*see* 780 CMR 120.Y). There is no explicit State Building Code obligation for owners of historic properties to apply for 780 CMR 9309 building classification as either totally preserved or partially preserved but other local, state or federal criteria may/will dictate at least true totally preserved, historic building classification.

Partially preserved status—see definition of same below and note that in the absence of such designation, for Building Code purposes, an existing building will not be treated as a partially preserved historic building unless so designated.

Because historic buildings may be one- or two-family homes or other uses, 780 CMR 780 CMR 9309, does, at times, default to the Sixth Edition, Massachusetts State Building Code, Chapters 1 through 33 as applicable, for uses other than one-and two-family use, otherwise one- and two-family homes that are totally preserved historic buildings or partially preserved historic buildings are

addressed within 780 CMR 9309.

9309.1.1 Key Definitions. The following five definitions are found in 780 CMR 9301.1, but are also presented here as such definitions form a significant portion of 780 CMR 9309.

HISTORIC BUILDINGS:

1. Any building or structure individually listed on the National Register of Historic Places or
2. Any building or structure evaluated by the Massachusetts Historical Commission (MHC) to be a contributing building within a National Register or State Register District.
3. Any building or structure which has been certified by the Massachusetts Historical Commission to meet eligibility requirements for individual listing on the National Register of Historic Places. Historic building shall be further defined as totally or partially preserved buildings. All entries into the totally preserved building list shall be certified by the Massachusetts Historical Commission. The BBRS shall ratify all buildings or structures certified by the Massachusetts Historical Commission to qualify for totally preserved listing (*see* 780 CMR 120.Y).

PARTIALLY PRESERVED BUILDINGS.

1. Any building or structure individually listed on the National Register of Historic Places or
2. Any building or structure certified as an historic building by the Massachusetts Historical Commission and not designated a totally preserved building in Appendix 780 CMR 120.Y.

RESTORATION. Restoration is the process of accurately reconstructing or repairing the forms and details of a building or structure or portion thereof as it appeared at a particular period or periods of time by means of removal of later work or the replacement of missing original work

TOTALLY PRESERVED BUILDINGS. A totally preserved building is an historic building or structure. The principal use of such a building or structure must be as an exhibit of the building or the structure itself which is open to the public not less than 12 days per year, although additional uses, original and/or ancillary to the principal use shall be permitted within the same building up to maximum of 40% of the gross floor area. Totally preserved buildings shall be those listed in 780 CMR 120.Y. All entries into the totally preserved building list shall be certified by the Massachusetts Historical Commission. The BBRS shall ratify all buildings or structures certified by the Massachusetts Historical Commission to qualify for totally preserved listing (*see* 780 CMR 120.Y).

9309.2 Totally Preserved Buildings.

9309.2.1 General Structural Requirements.

Structural requirements for additions, and for existing buildings subject to repair, alteration and/or change of use, shall be in accordance with 780 CMR 5301 for one- and two-family dwellings (R-4 use) and otherwise, for all other uses per the *Sixth Edition, Massachusetts State Building Code*, 780 CMR 3400.3(10) noting Totally Preserved Historic Buildings need not comply with the wind load and seismic load requirements of the *Sixth Edition, Massachusetts State Building Code*, 780 CMR 3408.

9309.2.1.1 State Building Code Exceptions.

A totally preserved building shall be subject to the following exceptions:

1. Repairs, maintenance and restoration shall be allowed without conformity to 780 CMR generally, if the provisions of 780 CMR 9309.2.2 have been met.
2. In case of fire or other casualty to a totally preserved building, said building may be rebuilt, in total or in part, using such techniques and materials as are necessary to restore it to its original condition and use group.
3. If an historic building or structure, as a result of proposed work, would become eligible for certification as a totally preserved building and the Massachusetts Historical Commission so certifies by affidavit, such affidavit is submitted to the building official with the permit application, and the building official shall then allow the work to proceed under the provisions of 780 CMR 9309.2.

9309.2.2 Mandatory Safety Requirements. All totally preserved buildings shall comply to the following requirements.

9309.2.2.1 Fire Protection Equipment. Fire protection equipment shall be provided according to the following requirements.

1. Manual fire-extinguishing equipment. All use groups, other than Residential R-3 and R-4, shall have approved manual fire-extinguishing equipment, as determined by the head of the local fire department.
2. Fire protective signaling systems (fire alarm systems). All residential buildings in Use Groups R-1, R-2 and R-3 shall conform to the applicable requirements of the *Sixth Edition, Massachusetts State Building Code* Chapter 9 (780 CMR 9), as applicable. All R-4 use groups shall comply with 780 CMR 9309.2.2.1.2.(a) and (b).

(a) **Locations.** Provide smoke detectors in accordance with manufacturers listing and spacing requirements, but not less than one, for every 1,200 square feet (111

m²) of floor area per level. In addition, all lobbies, common corridors, hallways and exitway access and discharge routes shall be provided with approved smoke detectors installed in accordance with the manufacturers listing and spacing requirements but not more than 30 feet (9144 mm) spacing between detectors. All required smoke detectors shall have an alarm audible throughout the structure or building.

Any rooms or spaces that are actively utilized as sleeping rooms or sleeping spaces shall likewise have smoke detectors in each sleeping room/sleeping space.

(b) Single-station and multiple-station smoke detection devices. Smoke detectors of single-station and multiple-station types shall meet the requirements of UL 217 and be listed or approved by a nationally recognized fire-testing laboratory. All other smoke detectors shall be listed in accordance with UL 268 as listed in 780 CMR 100: *Referenced Standards*.

3. **Manual Pull Stations.** A manual fire alarm pull station shall be provided in the natural path of egress in all use groups except R-3 and R-4. Manual pull stations shall be connected to the building fire warning system in conformance with NFPA 72 as listed in 780 CMR 100: *Referenced Standards*.

9309.2.2.1.1 Supervision. Fire protective signaling systems required by 780 CMR 9309.2.2.1 shall be supervised in accordance with the applicable requirements of NFPA 72 as referenced in 780 CMR 100: *Referenced Standards*.

Exception: Residential single and multiple station smoke detectors.

9309.2.2.2 Exit Signs and Emergency Lights. Approved exit signs and emergency lighting, where required, shall be provided in compliance with requirements of the *Sixth Edition, Massachusetts State Building Code* (780 CMR 10.00, 780 CMR 1023.0 and 780 CMR 1024.0).

Exception: All totally preserved buildings need not comply with 780 CMR 1023.0 and 780 CMR 1024.0 if not occupied after daylight hours, except that paths of egress shall have exit signs.

9309.2.2.3 Maximum Occupancy. Occupancy shall be limited by the actual structural floor load capacity as certified by a qualified Massachusetts-registered professional engineer or architect or in accordance with the *Sixth Edition, Massachusetts State Building*

Code, 780 CMR 1008.0, whichever is less. Said floor load shall be posted in accordance with the procedures set forth in 780 CMR 5120.0 as well as in accordance with the posting requirements of the *Sixth Edition, Massachusetts State Building Code*, 780 CMR 1003.3 and 780 CMR 1617.2. The owner shall submit evidence of this certification and related computations to the building official upon request.

(Also see 780 CMR 9309.2.1, relative to structural design requirements).

9309.2.2.4 Limited Egress. Where one or more floors of a totally preserved building are limited to one means of egress, the occupancy load shall be computed as follows:

1. Floors below the first story. Not more than one occupant per 100 square feet (9.3 m²) of gross floor area with a maximum occupancy of 49.
2. First story. Not more than one occupant per 50 square feet (4.6 m²) of gross floor area.
3. Second story and above. Not more than one occupant per 100 square feet (9.3 m²) of gross floor area, or 30 occupants per unit of egress width, whichever condition results in the lesser occupancy load.

9309.2.2.5 Inspections. The building official and the fire official shall inspect all totally preserved buildings not less frequently than once every year in order to determine that the building or structure continues to conform to 780 CMR 9309.2. A qualified Massachusetts-registered professional engineer or architect shall certify every five years thereafter as to the exact floor load capacity of the building or structure. The building official shall certify all totally preserved buildings not less frequently than once every year. Fees shall be established at \$25.00 per building per inspection.

9309.2.2.6 Accessibility for Persons with Disabilities. Accessibility requirements, as applicable, shall be in accordance with 521 CMR.

9309.2.2.7 Energy Conservation. Totally preserved buildings are exempt from the requirements of the *Sixth Edition, Massachusetts State Building Code*, Chapter 780 CMR 13 and the energy conservation requirements of the *Seventh Edition, Massachusetts Building Code for One- and Two-family Dwellings* (780 CMR 51.00 through 99.00).

9309.3 Partially Preserved Buildings.

9309.3.1 General Structural Requirements.

Structural requirements for additions, and for existing buildings subject to repair, alteration

and/or change of use, shall be in accordance with 780 CMR 5301 for one- and two-family dwellings (R-4 use) and otherwise in accordance with the *Sixth Edition, Massachusetts State Building Code*, 780 CMR 3400.3(10), except partially preserved historic buildings need not comply with the seismic load requirements of the *Sixth Edition, Massachusetts State Building Code*, 780 CMR 3408.

9309.3.1.1 State Building Code Provisions.

A partially preserved building shall be subject to the following provisions:

1. Existing Systems-individual components of an existing building system may be repaired or replaced in kind without requiring that system to comply fully with the code for new construction. (See 780 CMR 93.00, 780 CMR 9304.2, New Systems)
2. Replacement in kind-when the repair of historic materials including patching, splicing, piecing-in, consolidating or reinforcing is not possible, compatible materials may be substituted which closely convey the form and design as well as the visual appearance of the existing feature.

9309.3.2 State Building Code Exceptions. A partially preserved building shall be subject to the following exceptions. Repairs or in kind replacement of the following features will be allowed on partially preserved buildings so as not to compromise the architectural integrity of the historical characteristics and qualities which contributed to the eligibility for listing in the National Register of Historic Places.

1. Roofing-repair or in kind replacement of an existing historic roof system (i.e., slate, wood, clay, tile, metal) shall be permitted without requiring structural compliance for equivalent new construction, providing that dead and live loading requirements have not changed.
2. Windows-repair or in kind replacement of existing historic windows (i.e., frames, sash, muntins, glazing, sills, molding, shutters) shall be permitted without requiring energy code compliance.
3. Entries/Porches-repair or in kind replacement of existing individual decorative features of an existing system (i.e. columns, balustrades, stairs, pilasters, doors, sidelights) shall be permitted.
4. Wood siding/Decorative elements-Repair or in kind replacement of an existing system including such items as clapboards, shingles, cornices, brackets, and window and door surrounds shall be permitted.
5. Masonry-repair or in kind replacement of masonry units as part of an existing system

(i.e., brick, stone, terra cotta, concrete and stucco) shall be permitted.

6. Metals—repair or in kind replacement of existing architectural metals (i.e. cast and wrought iron, steel, tin, copper and copper alloys, aluminum, zinc) shall be permitted.

7. Interior features—repair or in kind replacement of nonstructural interior features that are important in defining the overall historic character of a building (i.e., columns, cornices, baseboards, fireplace mantels, paneling, window trim, doors, moldings, railings, flooring, plasterwork) shall be permitted.

9309.3.3 Applicability. 780 CMR 9309.3 and 780 CMR 93.00, generally, shall apply to all partially preserved historic buildings.

9309.3.4 Continuation of Use and Occupancy. The legal use and occupancy of any partially preserved building may be continued without change or further compliance to 780 CMR. The provisions of 780 CMR 93.00 generally shall be required for historic buildings accessible to the public on more than 50 days per year – this as a partially preserved historic building, by use group, could be of any use and public safety is required to be maintained for the applicable use.

9309.3.5 Inspection Certification and Fees. Partially preserved buildings shall not require annual inspection unless otherwise stipulated in 780 CMR 106 and Table 106 of the *Sixth Edition, Massachusetts State Building Code*.

9309.3.6 Fire Damage. If a building or structure is damaged from fire or other casualty it may be restored to its original construction or it shall meet the requirements of 780 CMR provided these requirements do not compromise the features for which the building was considered historic when listed in the National Register of Historic Places.

309.3.7 Change in Occupancy. See 780 CMR 93.00, generally.

9309.3.8 New Systems. See 780 CMR 93.00.

9309.3.9 Lesser and Equal Hazard. See 780 CMR 93.00. For other than one- and two-family dwellings, a partially preserved building classified in the *Sixth Edition, Massachusetts State Building Code* as unprotected construction Type 3C or 5B shall have waived the requirement to add one to the Hazard Index number (see *Sixth Edition, Massachusetts State Building Code*, 780 CMR Table 3403).

9309.3.10 Greater Hazard. See 780 CMR 93.00. For other than one- and two-family dwellings, a partially preserved building classified in the *Sixth Edition, Massachusetts State Building Code* as unprotected construction Type 3C or 5B shall have waived the requirement to add one to the Hazard Index number (see *Sixth Edition, Massachusetts State Building Code*, 780 CMR Table 3403).

9309.3.11 Energy Conservation. Partially preserved buildings are exempt from the energy requirements of *Sixth Edition, Massachusetts State Building Code*, Chapter 780 CMR 13 and the energy requirements of 780 CMR 61.00 of the *Seventh Edition, Massachusetts Building Code* for One- and Two-Family Dwellings.

Exception: Additions to partially preserved buildings shall comply with the energy provisions of the *Sixth Edition, Massachusetts State Building Code*, Chapter 780 CMR 13 or of 780 CMR 61.00 of the *Seventh Edition, Massachusetts Building Code* for One- and Two-family Dwellings as applicable.

9309.3.12 Accessibility for Persons with Disabilities. Accessibility requirements shall be in accordance with 521 CMR.

(780 CMR 94.00 THROUGH 99.00: RESERVED)

(PAGES 877 THROUGH 900 ARE RESERVED FOR FUTURE USE.)

780 CMR 100.00

REFERENCED STANDARDS

This chapter lists the standards that are referenced in various sections of this document. The standards are listed herein by the promulgating agency of the standard, the standard identification, the effective date and title, and the section or sections of this document that reference the standard. The application of the referenced standard shall be as specified in 780 CMR 5102.4.

AAMA		American Architectural Manufacturers Association 1827 Walden Office Square, Suite 550 Schaumburg, IL 60173
Standard reference number	Title	Referenced in code section number
101/L.S2—97	Voluntary Specifications for Aluminum, Vinyl (PVC) and Wood Windows and Glass Doors	5613.3, 6101.3.2.2,
101/L.S2/NAFS—02	Voluntary Performance Specification for Windows, Skylights and Glass Doors	5308.6.9, 5613.3, 6101.3.2.
ACI		American Concrete Institute 38800 Country Club Drive Farmington Hills, MI 48333
Standard reference number	Title	Referenced in code section number
318—02	Building Code Requirements for Structural Concrete . . .	5402.2, 5404.1, 5404.4, 5404.4.6.1, Table 5404.4(1), Table 5404.4(2), Table 5404.4(3), Table 5404.4(4), Table 5404.4(5), 5611.1, Table 5611.3(1), Table 5611.7(1), Table 5611.7(2), Table 5611.7(3), Table 5611.7(4), Table 5611.7(5), Table 5611.7(6), Table 5611.7(7), Table 5611.7(9), Table 5611.7(10), 5611.7.1.1, Table 5611.7.4, 5612.1
530—02	Building Code Requirements for Masonry Structures	5404.1, 5606.1, 5606.1.1, 5606.11.1, 5606.11.2.2.1, 5606.11.2.2.2, 5606.11.3.1
530.1—02	Specifications for Masonry Structures	5404.1, 5606.1, 5606.1.1, 5606.11.1, 5606.11.2.2.1, 5606.11.2.2.2, 5606.11.3.1
ACCA		Air Conditioning Contractors of America 2800 Shirlington Road, Suite 300 Arlington, VA 22206
Standard reference number	Title	Referenced in code section number
Manual D—95	Residential Duct Systems	6601.1, 6602.2
Manual J—87	Residential Load Calculation—Seventh Edition	6401.3

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AFPA American Forest and Paper Association
111 19th Street, NW, Suite 800
Washington, DC 20036

Standard reference number	Title	Referenced in code section number
NDS—01	National Design Specification (NDS) for Wood Construction— with 2001 Supplement	5404.2.2, 5502.2, Table 5503.1, 5602.3, 5802.2
WFCM—2001	Wood Frame Construction Manual for One- and Two-family Dwellings	530 1.2.1.1
AFPA—93	Span Tables for Joists and Rafters	5502.3, 5802.4, 5802.5
T.R. No. 7—87	Basic Requirements for Permanent Wood Foundation System	5401.1

AHA American hard Board Association
1210 West Northwest Highway
Palatine, IL 60067

Standard reference number	Title	Referenced in code section number
A135.4—95	Basic Hardboard	Table 5602.3(1)
A135.5—95	Prefinished Hardboard Paneling	5702.5
A135.6—98	Hardboard Siding	Table 5703.4
A194.1—85	Cellulosic Fiber Board	Table 5602.3(1)

AISI American Iron and Steel Institute
1140 Connecticut Ave, Suite 705
Washington, DC 20036

Standard reference number	Title	Referenced in code section number
Header—2001	Standard for Cold-formed Steel Framing-Header Design, 2001	5603.6
PM—2001	Standard for Cold-formed Steel Framing-Prescriptive Method for One- and Two-family Dwellings	5301.1.1, 5301.2.1.1(4), 5301.2.2.4.1, 5301.2.2.4.5
Truss—2001	Standard for Cold-formed Steel Framing-Truss Design	5804.1.3

AITC American Institute of Timber Construction
7012 S. Revere parkway Suite 140
Englewood, CO 80112

Standard reference number	Title	Referenced in code section number
AITC A 190.1—92	Structural Glued Laminated Timber	5502.1.5, 5602.1.2, 5802.1.4

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REFERENCED STANDARDS

ANSI			American National Standards Institute 25 West 23 rd Street, Fourth Floor New York, NY 10036	
Standard reference number	Title	Referenced in code section number		
A108.1A—99	Installation of Ceramic Tile in the Wet-set Method, with Portland Cement Mortar	5702.4.1		
A108.1B—99	Installation of Ceramic Tile, Quarry Tile on a Cured Portland Cement Mortar Setting Bed with Dry-set or Latex-Portland Mortar	5702.4.1		
A108.4—99	Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile-setting Epoxy Adhesive	5702.4.1		
A108.5—99	Installation of Ceramic Tile with Dry-set Portland Cement Mortar or Latex- Portland Cement Mortar	5702.4.1		
A108.6—99	Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-setting and -grouting Epoxy	5702.4.1		
A108.11—99	Interior Installation of Cementitious Backer Units	5702.4.1		
A118.1—99	American National Standard Specifications for Dry-set Portland Cement Mortar	5702.4.1		
A118.3—99	American National Standard Specifications for Chemical Resistant, Water Cleanable Tile-setting and Grouting Epoxy and Water Cleanable Tile-setting Epoxy Adhesive	5702.4.1		
A136.1—99	American National Standard Specifications for Organic Adhesives for Installation of Ceramic Tile	5702.4.1		
A137.1—88	American National Standard Specifications for Ceramic Tile	5702.4.1		
A208.1—99	Particleboard	5503.3.1, 5605.1		
Z21.48—92	Gas-fired Gravity and Fan-type Floor Furnace—with Addendum A-1993 (Replaced by Z21.86—98/CSA 2.32—M98, Vented Gas-fired Space-heating Appliances)	G2437.1		
Z21.49—92	Gas-fired Gravity and Fan-type Vented Wall Furnaces—with Addendum B-1994 (Replaced by Z21.86—98/CSA 2.32—M98, Vented Gas-fired Space-heating Appliances)	G2436.1		
Z21.50—2000	Vented Gas Fireplaces—with Addendum A-1999 and Addendum B-1999	G2434.1		

APA			APA - The Engineered Wood Association P.O. Box 11700 Tacoma, WA 98411-0700	
Standard reference number	Title	Referenced in code section number		
APA E30—01	Engineered Wood Construction Guide	5803.2.3		

ASCE			American Society of Civil Engineers 1801 Alexander Bell Drive Reston, MA 20191	
Standard reference number	Title	Referenced in code section number		
5—02	Building Code Requirements for Masonry Structures	5404.1, 5606.1, 5606.1.1, 5606.11.1, 5606.11.2.2.1, 5606.11.2.2.2, 5606.11.3.1		
6—02	Specifications for Masonry Structures	5404.1, 5606.1, 5606.1.1, 5606.11.1, 5606.11.2.2.1, 5606.11.2.2.2, 5606.11.3.1		
7—02	Minimum Design Loads for Buildings and Other Structures	5301.2.11		
32—01	Design and Construction of Frost Protected Shallow Foundations	5403.1.4.1		

ASHRAE			American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. 1791 Tullie Circle, NE Atlanta, GA 30329	
Standard reference number	Title	Referenced in code section number		
34—2001 ASHRAE—2001	Designation and Safety Classification of Refrigerants	6411.1		

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ASTM		ASTM International 100 Barr Harbor Drive West Conshohocken, PA 19428	
Standard reference number	Title	Referenced in code section number	
A 36/A 36M—01	Specification for Carbon Structural Steel	5606.14	
A 53/A 53M—01	Specification for Pipe Steel Black and Hot-dipped Zinc-coated Welded and Seamless	Table 7101.1	
A 106—99e	Specification for Seamless Carbon Steel Pipe for High Temperature Service ..	Table 7101.1	
A 153—01a	Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware	Table 5606.14.1	
A 167—99	Specification for Stainless and Heat-resisting Chromium-nickel Steel Plate Sheet and Strip	5606.14, Table 5606. 14.1	
A 254—97	Specification for Copper Brazed Steel Tubing	Table 7101.1	
A 510M—00	Specification for General Requirements for Wire Rods and Coarse Round Wire Carbon Steel Metric	5606.14,	
A 525-87	Specification for Steel Sheet Zinc-coated (Galvanized) Steel Wire	Table 5606.14.1, 7601.1.1	
A 539—99	Specification for Electronic-resistance-welded Coiled Steel Tubing for Gas and Fuel Oil Lines	7202.1	
A 615/A 0615M—01b	Specification for Deformed and Plain Billet-steel Bars for Concrete Reinforcement	5404.4.6.1, 5611.6.2	
A 641/A 0641M—98	Specification for Zinc-coated (Galvanized) Carbon Steel Wire	Table 5606.14.1	
A 653/A 0653M—00	Specification for Steel Sheet Zinc-coated (Galvanized) or Zinc-iron Alloy-coated (Galvanized) by the Hot-dip Process	5505.2.1, 5505.2.3, 5603.2.1, 5603.2.3, 5804.2.1, 5804.2.3, Table 5905.10.3	
A 706M—00	Specification for Low-alloy Steel Deformed and Plain Bars for Concrete Reinforcement	5404.4.6.1, 5611.6.2	
A 755M—99	Specification for Steel Sheet Metallic Coated by the Hot-dip Process and Prepainted by the Coil-coating Process for Exterior Exposed Building Products	Table 5905.10.3	
A 792M—99	Specification for Steel Sheet, 55% Aluminum-zinc Alloy-coated by the Hot-dip Process	5505.2.1, 5603.2.1, 5603.2.3, 5804.2.1,	
A 875/0875M—01a	Specification for Steel Sheet Zinc-5% Aluminum Alloy-coated by the Hot-dip Process	5505.2.1, 5505.2.3, 5603.2.1, 5603.2.3, 5804.2.1, 5804.2.3	
A 951—00	Specification for Masonry Joint Reinforcement	5606.14	
A 996/A 996M-00	Specifications for Rail-steel and Axel-steel Deformed Bars Reinforcement for Concrete	5404.4.6.1 5611.6.2	
B 42—98	Specification for Seamless Copper Pipe, Standard Sizes	Table 7101.1	
B 43—98	Specification for Seamless Red Brass Pipe, Standard Sizes	Table 7101.1	
B 75—99	Specification for Seamless Copper Tube	Table 7101.1	
B 88—99e1	Specification for Seamless Copper Water Tube	Table 7101.1	
B 10 1—96	Specification for Lead-coated Copper Sheet and Strip for Building Construction	Table 5905.10.3	
B 135—00	Specification for Seamless Brass Tube (Metric)	Table 7101.1	
B 209—96	Specification for Aluminum and Aluminum-alloy Sheet and Plate	Table 5905.10.3	
B 227—98	Specification for Hard-drawn Copper-clad Steel Wire	5606.14	
B 251—97	Specification for General Requirements for Wrought Seamless Copper and Copper-alloy Tube	Table 7101.1	
B 280—99	Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service	74 14.5.2	
B 302—00	Specification for Threadless Copper Pipe, Standard Sizes	Table 7101.1	
B 306—99	Specification for Copper Drainage Tube (DWV)	Table 7101.1	

ASTM - continued

Standard reference number	Title	Referenced in code section number
B 370—98	Specification for Copper Sheet and Strip for Building Construction	Table 5905.10.3
B 633—98e01	Specification for Electrodeposited Coatings of Zinc on Iron and Steel	5505 .2.4, 5603 .2.4, 5804.2.4
B 813—00e01	Specification for Liquid and Paste Fluxes for Soldering Applications of Copper and Copper Alloy Tube	Table 7101.1
C 5—79(97)	Specification for Quicklime for Structural Purposes	5702.2
C 27—98	Classification of Fireclay and High-alumina Refractory Brick	6003.5, 6003.8
C 28/C28M—00	Specification for Gypsum Plasters	5702.2
C 34—96(2001)	Specification for Structural Clay Load-bearing Wall Tile	Table 530 1.2(1)
C 35—95(2001)	Specification for Inorganic Aggregates for Use in Gypsum Plaster	5702.2
C 36/C 0036M—01	Specification for Gypsum Wallboard	5702.3.1
C 37/C 0037M—01	Specification for Gypsum Lat	5702.2
C 55—01	Specification for Concrete Brick	5202, Table 5301.2(1)
C 59/C 0059M —00	Specification for Gypsum Casting and Molding Plaster	5702.2
C 61/C 0061M—00	Specification for Gypsum Keene's Cement	5702.2
C 62—01	Specification for Building Brick (Solid Masonry Units Made from Clay or Shale)	5202, Table 530 1.2(1)
C 73—99a	Specification for Calcium Silicate Face Brick (Sand Lime Brick)	5202, Table 530 1.2(1)
C 79—01	Specification for Treated Core and Nontreated Core Gypsum Sheathing Board	Table 5602.3(1), 5702.3.1
C 90—01	Specification for Load-bearing Concrete Masonry Units	Table 530 1.2(1)
C 129—01	Specification for Nonload-bearing Concrete Masonry Units and Related Units	Table 530 1.2(1)
C 143/C 0143M—00	Test Method for Slump or Hydraulic Cement Concrete	5404.4.5, 5611.6.1
C 145—85	Specification for Solid Load-bearing Concrete Masonry Units	5202, Table 530 1.2(1)
C 199—84(2000)	Test Method for Pier Test for Refractory Mortar	6001.9, 6003.5, 6003.8
C 207—97	Specification for Hydrated Lime for Masonry Purposes	Table 5607.1
C 208—95(200 1)	Specification for Cellulosic Fiber Insulating Board	Table 5602.3(1)
C 216—01a	Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale)	5202, Table 5301.2(1)
C 236—89 (1993)e1	Test Method for Steady-State Thermal Performance of Building Assemblies by Means of a Guarded Hot Box	6102.1.1.1
C 270—01a	Specification for Mortar for Unit Masonry	5607.1
C 315—00	Specification for Clay Flue Lining	Table 6001.11(1), Table 6001.11(2), 6001.8.1, 7425.12
C 406—00	Specifications for Roofing Slate	5905.6.4
C 411—97	Test Method for Hot-surface Performance of High-temperature Thermal Insulation	660 1.2.1
C 475—01	Specification for Joint Compound and Joint Tape for Finishing Gypsum Wallboard	5702.3.1
C 476—01	Specification for Grout for Masonry	5609.1.1
C 514—01	Specification for Nails for the Application of Gypsum Wallboard	5702.3.1
C 557—99	Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing	5702.3.1
C 578—01	Specification for Rigid, Cellular Polystyrene Thermal Insulation	5403.3
C 587—97	Specification for Gypsum Veneer Plaster	5702.2
C 588/C0588M—99	Specification for Gypsum Base for Veneer Plasters	5702.2

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Standard reference number	Title	Referenced in code section number
C 630/0630M—01	Specification for Water-resistant Gypsum Backing Board	5702.3.1, 5702.4.2
C 631—(2000)	Specification for Bonding Compounds for Interior Gypsum Plastering	5702.2
C 645—00	Specification for Nonstructural Steel Framing Members	5702.3.3
C 652—01a	Specification for Hollow Brick (Hollow Masonry Units Made from Clay or Shale)	5202, Table 5301.2(1)
C 836—00	Specification for High Solids Content, Cold Liquid-applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course	5905.15.2
C 843—99	Specification for Application of Gypsum Veneer Plaster	5702.2
C 844—99	Specification for Application of Gypsum Base to Receive Gypsum Veneer Plaster .	5702.2
C 847—(2000)	Specification for Metal Lath	5702.2
C 887—79(96)e ¹	Specification for Packaged, Dry, Combined Materials for Surface Bonding Mortar .	5406.1
C 897—00	Specification for Aggregate for Job-mixed Portland Cement-based Plasters	5702.2
C 93 1—97	Specification for Exterior Gypsum Soffit Board	5702.3.1
C 933—96a(2001)	Specification for Welded Wire Lath	5702.2
C 954—00	Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness	5505.2.4, 5603.2.4, 5702.3.6, 5804.2.4
C955—01	Specification for Load-Bearing Transverse and Axial Steel Studs, Runners Tracks, and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases	5702.3 .3
C 957—93(1998)	Specification for High-solids Content, Cold Liquid—Applied Elastomeric Waterproofing Membrane for Use with Integral Wearing Surface	5905.15.2
C 960—01	Specification for Predecorated Gypsum Board	5702.3.1
C 976—90(1996)e1	Test Method for Thermal Performance of Building Assemblies by Means of a Calibrated Hot Box	6102.1.1.1
C 1002—01	Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases	5702.3.1, 5702.3.6, Table 5702.3.4
C 1029—96	Specification for Spray-applied Rigid Cellular Polyurethane Thermal Insulation .	5905.14.2
C 1032—96	Specification for Woven Wire Plaster Base	5702.2
C 1047—99	Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base	5702.2, 5702.3.1
C 1063—99	Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-based Plaster	5702.2
C 1157—00a	Performance Specification for Hydraulic Cement	5402.2
C 1167—96	Specification for Clay Roof Tiles	5905.3, 5905.3.4
C 1177/C 1177M—01	Specification for Glass Mat Gypsum Substrate for Use as Sheathing	5702.3.1
C 1178/C 1178M—01	Specification for Glass Mat Water-resistant Gypsum Backing Panel	5702.3.1, 5702.4.2
C 1186—99	Specification for Flat Nonasbestos Fiber Cement Sheets	5703.4
C 126 1—98	Specification for Firebox Brick for Residential Fireplaces	5003.5, 5003.8
C 1278/C 1278M—01	Specification for Fiber-reinforced Gypsum Panels	5702.3.1
C 1283—00e01	Practice for Installing Clay Flue Lining	6001.9
C 1395/C 1395M—01	Specification for Gypsum Ceiling Board	5702.3.1
C 1396—99	Specification for Gypsum Board	5702.3.1
C 1492—01	Specification for Concrete Roof Tile	5905.3.5
D 41—e01	Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing	Table 5905 .9.2, Table 5905.11.2

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Standard reference number	Title	Referenced in code section number
D 43—00	Specification for Coal Tar Primer Used in Roofing, Dampproofing and Waterproofing	Table 5905.9.2
D 224—89(1996)	Specification for Smooth-surfaced Asphalt Roll Roofing (Organic Felt)	5905.2.8.2
D 225—01	Specification for Asphalt Shingles (Organic Felt) Surfaced with Mineral Granule	5905.2.4
D 226—97a	Specification for Asphalt-saturated (Organic Felt) Used in Roofing and Waterproofing 5703.2, 5703.9.1, Table 5905.2.3, 5905.4.3, 5905.5.3, 5905.5.4, 5905.6.3, 5905.7.3, 5905.8.3, 5905.8.4, Table 5905.9.2	
D 227—97a	Specification for Coal Tar Saturated (Organic Felt) Used in Roofing and Waterproofing	Table 5905 .9.2
D 249—89(96)	Specification for Asphalt Roll Roofing (Organic Felt) Surfaced with Mineral Granules	Table 5905.9.2, 5905.2.8.2, 5905.3.3, 5905.5.4
D 0312—00	Specification for Asphalt Used in Roofing	5905 .9.2
D 37 1—89(1996)	Specification for Asphalt Roll Roofing (Organic Felt) Surfaced with Mineral Granules: Wide-selvaqe	5905 .5 .4
D 422—63(1998)	Test Method for Particle-size Analysis of Soils	5403.1.7.5.1
D 449—89(1999)e01	Specification for Asphalt Used in Dampproofing and Waterproofing	5406.2
D 450—(00)e ¹	Specification for Coal-tar Pitch Used in Roofing , Dampproofing and Waterproofing	Table 5905 .9.2
D 1227—00	Specification for Emulsified Asphalt Used as a Protective Coating for Roofing	Table 5905.9.2, Table 590511.2, 5905.15.2
D 1248—00a	Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable	6601.1.2
D 1693—01	Test Method for Environmental Stress-cracking of Ethylene PlasticTable	7101.1
D 1784—99a	Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds	6601.1.2
D 1863—93(2000)	Specification for Mineral Aggregate Used in Built-up Roofs	Table 5905 .9.2, Table 5906.3.2
D 1970—01	Specification for Self-adhering Polymer Modified Bitumen Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection	5905.2.3, 5905.2.8.3
D 2178—97a	Specification for Asphalt Glass Felt Used in Roofing and Waterproofing	Table 5905 .9.2
D 2412—96a	Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-plate Loading	6601.1.2
D 2447—01	Specification for Polyethylene (PE) Plastic Pipe Schedules 40 and 80, Based on Outside Diameter	Table 7101
D 2513—01a	Specification for Thermoplastic Gas Pressure Pipe, Tubing, and Fittings	Table 7101.1, 7104.2.1.3
D 2626—97b	Specification for Asphalt-saturated and Coated Organic Felt Base Sheet Used in Roofing	5905 .3 .3, Table 5905.9.2
D 2683—98	Specification for Socket-type Polyethylene Fittings for Outside Diameter-controlled Polyethylene Pipe and Tubing	Table 7101.1,7104.2.1.1
D 2822—91(1997)e ¹	Specification for Asphalt Roof Cement	Table 5905.9.2, Table 5905.11.2
D 2823—90(1997)e ¹	Specification for Asphalt Roof Coatings	Table 5905.9.2, Table 5905.11.2
D 2824—94	Specification for Aluminum-pigmented Asphalt Roof Coatings, Non-fibered, Asbestos Fibered, and Fibered without Asbestos	Table 5905.9.2, Table 5905.11.2
D 2837—98a	Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials	Table 7101.1
D 2846/D 2846M—99	Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Hot- and Cold-water Distribution Systems	7101.1

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Standard reference number	Title	Referenced in code section number
D 2898—94(1999)	Test Methods for Accelerated Weathering of Fire-retardant-treated Wood for Fire Testing	5802.1.3.3, 5902.2
D 3019—e01	Specification for Lap Cement Used with Asphalt Roll Roofing, Non-fibered, Asbestos Fibered, and Non-asbestos Fibered	Table 5905.9.2, Table 5905.11.2
D 3035—01	Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based On Controlled Outside Diameter	Table 7101.1
D 3161—99a	Test Method for Wind Resistance of Asphalt Shingles (Fan Induced Method) ...	5905.2.6
D 3201—94(1998)e1	Test Method for Hygroscopic Properties of Fire-retardant Wood and Wood-base Products	5802.1.3.4
D 3309—96a	Specification for Polybutylene (PB) Plastic Hot- and Cold-water Distribution Systems	Table 7101.1
D 3350—01	Specification for Polyethylene Plastic Pipe and Fitting Materials	Table 7101.1
D 3462—01e01	Specification for Asphalt Shingles Made From Glass Felt and Surfaced with Mineral Granule	5905.2.4
D 3468—99	Specification for Liquid-applied Neoprene and Chlorosulfanated Polyethylene Used in Roofing and Waterproofing	Table 5905.15.2
D 3679—01c	Specification for Rigid Poly (Vinyl Chloride) (PVC) Siding	Table 5703.4
D 3737—99	Practice for Establishing Allowable Properties for Structural Glued Laminated Timber (Glulam)	5502.1.5, 5602.1.2, 5802.1.4
D 3747—e01	Specification for Emulsified Asphalt Adhesive for Adhering Roof Insulation	Table 5905.9.2, Table 5905.11.2
D 3909—97b	Specification for Asphalt Roll Roofing (Glass Felt) Surfaced with Mineral Granules	5905.5.4, Table 5905.9.2, Table 5906.3.2
D 4022—94(00)e ¹	Specification for Coal Tar Roof Cement, Asbestos Containing	Table 5905.9.2
D 4318—00	Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils ...	5403.1.7.5.1
D 4434—96	Specification for Poly (Vinyl Chloride) Sheet Roofing	5905.13.2
D 4479—00	Specification for Asphalt Roof Coatings-Asbestos-free	Table 5905.9.2
D 4586—00	Specification for Asphalt Roof Cement-Asbestos-free	Table 5905.9.2
D 4601—98	Specification for Asphalt-coated Glass Fiber Base Sheet Used in Roofing ..	Table 5905.9.2
D 4637—96	Specification for EPDM Sheet Used in Single-ply Roof Membrane	5905.12.2
D 4829—95	Test Method for Expansion Index of Soils	5403.1.8.1
D 4869—88(1993)e ¹	Specification for Asphalt-saturated (Organic Felt) Underlayment Used in Steep Slope Roofing	5905.2.3
D 4897—01	Specification for Asphalt Coated Glass-fiber Venting Base Sheet Used in Roofing	Table 5905.9.2
D 4990—97a	Specification for Coal Tar Glass Felt Used in Roofing and Waterproofing ..	Table 5905.9.2
D 5019-96	Specification for Reinforced Non-vulcanized Polymeric Sheet Used in Roofing Membrane	5905.12.2
D 5055—00	Specification for Establishing and Monitoring Structural Capacities of Prefabricated Wood I-Joists	5502.1.4
D 5516—99a	Test Method for Evaluating the Flexural Properties of Fire-retardant-treated Softwood Plywood Exposed to the Elevated Temperatures	5802.1.3.2.1
D 5643—94(00)e ¹	Specification for Coal Tar Roof Cement Asbestos-free	Table 5905.9.2
D 5664—01	Test Methods For Evaluating the Effects of Fire-retardant Treatments and Elevated Temperatures on Strength Properties of Fire-retardant-treated Lumber	5802.1.3.2.2

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Standard reference number	Title	Referenced in code section number
D 5665—99a	Specification for Thermoplastic Fabrics Used in Cold-applied Roofing and Waterproofing	Table 5905.9.2
D 5726—98	Specification for Thermoplastic Fabrics Used in Hot-applied Roofing and Waterproofing	Table 5905.9.2
D 6083—97a	Specification for Liquid Applied Acrylic Coating Used in Roofing	Table 5905.9.2, Table 5905.11.2, Table 5905.15.2
D 6162—00a	Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcements	Table 5905.11.2
D 6163—00	Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Glass Fiber Reinforcements	Table 5905.11.2
D 6164—00	Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Polyester Reinforcements	Table 5905.11.2
D 622 1—00	Specification for Reinforced Bituminous Flashing Sheets for Roofing and Waterproofing	Table 5905.11.2
D 6222—00e01	Specification for Atactic Polypropelene (APP) Modified Bituminous Sheet Materials Using Polyester Reinforcement	Table 5905.11.2
D 6223—00e01	Specification for Atactic Polypropelene (APP) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcement	Table 5905.11.2
D 6298—98	Specification for Fiberglass Reinforced Styrene-Butadiene-Styrene (SBS) Modified Bituminous Sheets with a Factory Applied Metal Surface	Table 5905.11.2
D 6305—98e1	Practice for Calculating Bending Strength Design Adjustment Factors for Fire-Retardant-Treated Plywood Roof Sheathing	5802.1.3.2.1
E 84—01	Test Method for Surface Burning Characteristics of Building Materials	5202, 5314.1.1, 5314.2.6, 5314.3, 5315.3, 5316.1, 5316.2, 5802.1.3, 6601.2.1, 6601.4.2
E 96—00	Test Method for Water Vapor Transmission of Materials	5202, 6411.4, 6601.3 .4, 6102.1.7
E 108—99	Test Methods for Fire Tests of Roof Coverings	5902.1, 5902.2
E 119—00a	Test Methods for Fire Tests of Building Construction and Materials	5314.1.2, 5317.1, 5317.3.1
E 136—99	Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°	5202
E 152—95	Methods of Fire Tests of Door Assemblies	5314.3
E 330—97e ¹	Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference	5613.3
E 814—00	Test Method for Fire Tests of Through-penetration Firestops	5317.3.1.2
E 970—00	Test Method for Critical Radiant Flux of Exposed Attic Floor Insulation Using a Radiant Heat Energy Source	5316.5
E 1602—94	Guide for Construction of Solid Fuel Burning Masonry Heaters	6006.2
E 1886—97	Test Method for Performance of Exterior Windows, Curtain Walls, Doors and Storm Shutters Impacted by Missiles and Exposed to Cyclic Pressure Differentials	530 1.2.1.2
E 1996—01	Specification for Performance of Exterior Windows, Curtain Walls, Doors and Storm Shutters Impacted by Windborne Debris in Hurricanes	530 1.2.1.2
F 1055—98	Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene Pipe and Fittings	Table 7101.1, 7104.2.1.2
F 128 1—e01	Specification for Crosslinked Polyethylene/Aluminum/Crosslinked Polyethylene (PEX-AL-PEX) Pressure Pipe	Table 7101.1
F 1667—01a	Specification for Driven Fasteners, Nails, Spikes, and Staples	5905.2.5
F 1807—99	Specification for Metal Insert Fittings Utilizing a Copper Crimp Ring for SDR9 Cross-linked Polyethylene (PEX) Tubing	Table 7101.1

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AWPA American Wood-Preservers' Association
P.O. Box 5690
Granbury, Texas 76049

Standard reference number	Title	Referenced in code section number
C1—00	All Timber Products — Preservative Treatment by Pressure Processes	5319.1, 5323.1.7, 5902.2.1
C2—01	Lumber, Timbers, Bridge Ties and Mine Ties — Preservative Treatment by Pressure Processes	5319.1, 5323.1.7, Table 5905.8.5
C3—99	Piles — Preservative Treatment by Pressure Processes	5319.1, 5323.1.7
C4—99	Poles — Preservative Treatment by Pressure Processes	5319.1, 5323.1.7
C9—00	Plywood — Preservative Treatment by Pressure Processes	5319.1, 5323.1.7
C15—00	Wood for Commercial-Residential Construction Preservative Treatment by Pressure Process	5319.1, 5323.1.7
C18—99	Standard for Pressure Treated Material in Marine Construction	5319.1, 5323.1.7
C20—99	Structural Lumber—Fire-retardant Treatment by Pressure Processes	5802.1.3.2
C22—96	Lumber and Plywood for Permanent Wood Foundations — Preservative Treatment by Pressure Processes	5319.1, 5323.1.7, 5402.1.2, 5504.3
C23—00	Round Poles and Posts Used in Building Construction—Preservative Treatment by Pressure Processes	5319.1, 5323.1.7
C24—96	Sawn Timber Used to Support Residential and Commercial Structures . . .	5319.1, 5323.1.7
C27—88	Plywood—Fire-retardant Treatment by Pressure Process	5802.1.3.2
C28—99	Standard for Preservative Treatment by Pressure Process of Structural Glued Laminated Members and Laminations Before Gluing	5319.1, 5323.1.7
C31—01	Lumber Used Out of Contact With the Ground and Continuously Protected from Liquid Water—Treatment by Pressure Processes	5319.1
C33—00	Standard for Preservative Treatment of Structural Composite Lumber by Pressure Processes	5323.1
M4—01	Standard for the Care of Preservative-treated Wood Products	5320.3.1
P1/P13—01	Standard for Creosote Preservative	5319.1, 5323.1.7
P2—01	Standard for Creosote Solutions	5319.1, 5323.1.7
P3—01	Standard for Creosote-petroleum Solutions	5319.1, 5323.1.7

CDA The Copper Development Association, Inc.
260 Madison Avenue
New York, NY 10016

Standard reference number	Title	Referenced in code section number
4050	Copper in Architecture—Design Handbook	Table 5905.10.3

CGSB Canadian General Standards Board
Place du Portage 111, 6B1
11 Laurier Street
Gatineau, Quebec, Canada K1A 1G6

Standard reference number	Title	Referenced in code section number
37-GP—52M—(1984)	Roofing and Waterproofing Membrane, Sheet Applied, Elastomeric	5905.12.2
37-GP—56M—(1980)	Membrane, Modified Bituminous, Prefabricated and Reinforced for Roofing — with December 1985 Amendment	Table 5905.11.2
CAN/CGSB-37.54-95	Polyvinyl Chloride Roofing and Waterproofing Membrane	5905.13.2

CMR

Code of Massachusetts Regulations
Secretary of the Commonwealth
Regulations Division
One Ashburton Place, Boston, MA 02108

Various construction code requirements and other regulatory requirements are found in CMRs in addition to the regulatory requirements of the Massachusetts State Building Code (780 CMR); the CMRs identified below, along with the State Agency or Board that promulgates same, are referenced in the Seventh Edition of the Massachusetts State Building Code.

Standard reference number	Title	Referenced in code section number
105 CMR	Department of Public Health	When applicable
310 CMR	Department of Environmental Protection	When applicable
248 CMR	Board of State Examiners of Plumbers and Gasfitters	When applicable
520 CMR	Department of Public Safety	When applicable
521 CMR	Architectural Access Board	When applicable
522 CMR	Board of Boiler Rules	When applicable
524 CMR	Board of Elevator Regulations	When applicable
527 CMR	Board of Fire Prevention Regulations	When applicable

CPSC

Consumer Product Safety Commission
4330 East West Highway
Bethesda, MD 20814-4408

Standard reference number	Title	Referenced in code section number
16 CFR Part 1201 (1977)	Safety Standard for Architectural Glazing	R308.1.1, R308.3
16 CFR Part 1209 (1979)	Interim Safety Standard for Cellulose Insulation	R316.3
16 CFR Part 1404 (1979)	Cellulose Insulation	R316.3

CSA

Canadian Standards Association
178 Rexdale Blvd.
Rexdale (Toronto), Ontario, Canada M9W 1R3

Standard reference number	Title	Referenced in code section number
0325.0—92	Construction Sheathing (Reaffirmed 1998)	5503.2.1
0437-Series—93	Standards on OSB and Waferboard (Reaffirmed 2001)	5503.2.1, 5803.2.1

CSSB

Cedar Shake & Shingle Bureau
515 116th Avenue NE # 275
Bellevue, WA 98004-5294

Standard reference number	Title	Referenced in code section number
CSSB—97	Grading and Packing Rules for Western Red Cedar Shakes and Western Red Shingles of the Cedar Shake and Shingle Bureau ... Table 5905.7.4, 5702.6, 5703.5	
CSSB—97	Grading and Packing Rules for Western Red Cedar Shakes and Western Red Shingles of the Cedar Shake and Shingle Bureau	Table 5905.7.4, 5703.5

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DOC United States Department of Commerce
100 Bureau Drive Stop 3460
Gaithersburg, MD 20899

Standard reference number	Title	Referenced in code section number
PS 1—95	Construction and Industrial Plywood	5404.2.1, Table 5404.2.3, 5503.2.1, 5604.1, 5803.2.1
PS 2—92	Performance Standard for Wood-based Structural-use Panels	5404.2.1, Table 5404.2.3, 5503.2.1, 5604.1, 5803.2.1
PS 20—99	American Softwood Lumber Standard	5404.2.1, 5502.1, 5602.1, 5802.1

FEMA Federal Emergency Management Agency
500 C Street, SW
Washington, DC 20472

Standard reference number	Title	Referenced in code section number
TB-2—93	Flood-resistant Materials Requirements	5323.1.7
TB-11—01	Crawlspace Construction for Buildings Located in Special Flood Hazard Area	5408.6

FM Factory Manual
Standards Laboratories Department
1151 Boston Providence Turnpike
Norwood, MA 02062

Standard reference number	Title	Referenced in code section number
4450—(1989)	Approval Standard for Class 1 Insulated Steel Deck Roofs—with Supplements through July 1992	5906.1
4880—(2001)	American National Standard for Evaluating Insulated Wall or Wall and Roof/Ceiling Assemblies, Plastic Interior Finish Materials, Plastic Exterior Building Panels, Wall/Ceiling Coating Systems, Interior or Exterior Finish Systems	5314.3

GA Gypsum Association
810 First Street, Northeast, Suite 510
Washington, DC 20002-4268

Standard reference number	Title	Referenced in code section number
GA-253—99	Recommended Standard Specification for the Application of Gypsum Sheathing	Table 5602.3(1)

HPVA Hardwood Plywood & Veneer Association
1825 Michael Faraday Drive
Reston, VA 20190-5350

Standard reference number	Title	Referenced in code section number
HP-1—2000	The American National Standard for Hardwood and Decorative Plywood	5702.5

ICC International Code Council 5203 Leesburg Pike, Suite 600 Falls Church, VA 22041		
Standard reference number	Title	Referenced in code section number
IBC—03	International Building Code® . 5110.2, 5322.1, 5323.1, 5323.1.5, 5403.1.8, 6001.8.2, 7402.3	
ICC EC—03	Mass. Electrical Code—Administrative Provisions	5107.3
IMC—03	International Mechanical Code®	5104.11, 7106.1, 7402.3
SBCCI SSTD 10—99	Standard for Hurricane Resistant Construction	5301.2.1.1

NAIMA North American Insulation Manufacturers Association 44 Canal Center Plaza, Suite 310 Alexandria, VA 22314		
Standard reference number	Title	Referenced in code section number
AH 116 06—02	Fibrous Glass Duct Construction Standards	660 1.1.1

NCMA National Concrete Masonry Association 2302 Horse Pen Road Herndon, VA 20171-3499		
Standard reference number	Title	Referenced in code section number
TR 68-A—75	Design and Construction of Plain and Reinforced Concrete Masonry and Basement and Foundation Walls	5404.1

NFPA National Fire Protection Association Batterymarch Park Quincy, MA 02269		
Standard reference number	Title	Referenced in code section number
13—02	Installation of Sprinkler Systems	5317.1
13D—02	Installation of Sprinkler Systems in One- and Two-family Dwellings and Manufactured Homes	5313.4
72—02	National Fire Alarm Code	5313.1
211—03	<i>Chimneys, Fireplaces, Vents, and Solid-fuel-burning Appliances</i>	6007.1, Table 6007.6.1, 6007.11.1
259—98	Standard Test Method for Potential Heat of Building Materials	5314.2.5
286—00	Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth	5314.3, 5315.4
50 1—99	Standard on Manufactured Housing	5202
853—00	Standard for the Installation of Stationary Fuel Cell Power Plants	6903.1

NFRC National Fenestration Rating Counsel, Inc. 8484 Georgia Avenue, Suite 320 Silver Spring, MD 20910		
Standard reference number	Title	Referenced in code section number
100—2001	Procedure for Determining Fenestration Product U-factors	6101.3.2, 6101.3.2.1
200—2001	Procedure for Determining Fenestration product Solar Heat Gain Coefficients and Visible Transmittance at Normal Incidence	6101.3.2, 6101.3.2.1
400—2001	Procedure for Determining Fenestration Product Air Leakage	6101.3.2.2

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THE MASSACHUSETTS STATE BUILDING CODE**

RMA			Rubber Manufacturer's Association 1400 K Street N.W., Suite 900 Washington, DC 20005
Standard reference number	Title		Referenced in code section number
RP1—90	Minimum Requirements for Non-Reinforced Black EPDM Rubber Sheets	5905.12.2	
RP2—90	Minimum Requirements for Fabric-Reinforced Black EPDM Rubber Sheets	5905.12.2	
RP3—85	Minimum Requirements for Fabric-Reinforced Black Polychloroprene Rubber Sheets	5905.12.2	
SAE			Society of Automotive Engineers 400 Commonwealth Drive Warrendale, PA 15096
Standard reference number	Title		Referenced in code section number
J 78—(1998)	Steel Self-drilling Tapping Screws	5505.2.4, 5603.2.4, 5804.2.4	
SMACNA			Sheet Metal & Air Conditioning Contractors National Assoc., Inc. 4021 Lafayette Center Road Chantilly, VA 22021
Standard reference number	Title		Referenced in code section number
SMACNA—92	Fibrous Glass Duct Construction Standards	5601.1.1	
TMS			The Masonry Society 3970 Broadway, Suite 201-D Boulder, CO 80304
Standard reference number	Title		Referenced in code section number
402—02	Building Code Requirements for Masonry Structures .	5404.1, 5606.1, 5606.1.1, 5606.11.1, 5606.11.2.2.1, 5606.11.2.2.2, 5606.11.3.1	
602—02	Specification for Masonry Structures	5404.1, 5606.1, 5606.1.1, 5606.11.1, 5606.11.2.2.1, 5606.11.2.2.2, 5606.11.3.1	
TPI			Truss Plate Institute 583 D'Onofrio Drive, Suite 200 Madison, WI 53719
Standard reference number	Title		Referenced in code section number
TPI 1—2002	National Design Standard for Metal-plate-connected Wood Truss Construction	5502.11.1, 5502.11.2, 5802.10.2, 5802.10.3, 5802.11.1	

UL		
Underwriters Laboratories, Inc. 333 Pfingsten Road Northbrook, IL 60062		
Standard reference number	Title	Referenced in code section number
17—94	Vent or Chimney Connector Dampers for Oil-fired Appliances—with Revisions through September 1999	6802.2.2
58—96	Steel Underground Tanks for Flammable and Combustible Liquids—with Revisions through July 1998	7201.1
80—96	Steel Inside Tanks for Oil-burner Fuel	7201.1
103—98	Factory-built Chimneys for Residential Type and Building Heating Appliances—with Revision through March 1999	5202, 6002.3
127—99	Factory-built Fireplaces—with Revisions through November 1999	6002.4, 6003.12, 6004.1, 6004.4
174—98	Household Electric Storage Tank Water Heaters—with Revisions through October 1999	7005.1
181—96	Factory-made Air Ducts and Air Connectors—with Revisions through December 1998	6601.2, 6601.3.1
181A—95	Closure Systems for Use with Rigid Air Ducts and Air Connectors—with Revisions through December 1998	6601.2, 6601.3.1
181B—98	Closure Systems for Use with Flexible Air Ducts and Air Connectors—with Revisions through December 1998	6601.2, 6601.3.1
325—95	Door, Drapery, Louver and Window Operations and Systems—with Revisions through June 2001	5309.6
343—97	Pumps for Oil-Burning Appliances—with Revisions through December 22, 1999 ..	7204.1
536—97	Flexible Metallic Hose—with Revisions through October 2000	7202.3
641—95	Type L, Low-temperature Venting Systems—with Revisions through April 1999	5202, 6001.8.5, 6804.2.4
737—96	Fireplaces Stoves—with Revisions through May 1998	6002.3, 6414.1
790—98	Tests for Fire Resistance of Roof Covering Materials—with Revisions through July 1998 ..	9902.1
959—01	Medium Heat Appliance Factory-built Chimneys	6002.6
923—95	Microwave Cooking Appliances—with Revisions through July 20, 1998	6503.1
1040—96	Fire Test of Insulated Wall Construction—with Revisions through April 2001	5314.3
256—981	Fire Test of Roof Deck Construction—with Revisions through March 2000	5906.1
1479—94	Fire Tests of Through-Penetration Firestops	5317.3.1.2
1482—98	Solid-fuel Type Room Heaters—with Revisions through January 2000	6410.1
1715—97	Fire Test of Interior Finish Material	5314.3
1777—98	Chimney Liners—with Revisions through July 1998	6001.8.1, 6001.15, 6801.3.4
1995—98	Heating and Cooling Equipment—with Revisions through August 1998 ..	602.1, 6403.1, 6407.1
2158A—96	Outline of Investigation for Clothes Dryer Transition Duct	6501.1

ULC		
Underwriters' Laboratories of Canada 7 Crouse Road Scarborough, Ontario, Canada M1R 3A9		
Standard reference number	Title	Referenced in code section number
S 102—M88	Surface Burning Characteristics of Building Materials and Assemblies	5316.2

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WDMA Window & Door Manufacturers Association
1400 East Touhy Avenue, Suite 470
Des Plaines, IL 60018

Standard reference number	Title	Referenced in code section number
101/I.S. 2—97	Voluntary Specifications for Aluminum, Vinyl (PVC) and Wood Windows and Glass Doors	5613.3
101/I.S.2/NAFS—02	Voluntary Performance Specification for Windows, Skylights and Glass Doors	5308.6.9, 5613.3, 6101.3.2.2

(780 CMR 101.00 THROUGH 109.00: RESERVED)

(PAGES 919 THROUGH 924 ARE RESERVED FOR FUTURE USE.)

780 CMR 110.00

780 CMR 110.R1

CONCRETE TESTING LABORATORIES LICENSING

(Note: 780 CMR 110.R1 is unique to Massachusetts)

780 CMR 110.R1.1 Administration

110.R1.1.1 Scope. Provisions of 780 CMR 110.R1.1 shall govern the licensing of concrete testing laboratories.

110.R1.1.2 Definitions. The following words terms shall, for the purpose of 780 CMR 110.R1 and as used elsewhere in 780 CMR, have the meaning indicated in 780 CMR 110.R1.1.2:

ACCREDITED LABORATORY. A laboratory which has been licensed in accordance with 780 CMR 110.R1 by the State Board of Building Regulations and Standards (BBRS).

BBRS. State Board of Building Regulations and Standards (BBRS).

BRANCH LABORATORIES. A branch of a testing laboratory physically removed from the location of the headquarters or main testing facility of the testing laboratory.

LABORATORIES. Testing laboratory, branch laboratory and project laboratory.

PERSON. Individual, partnership, corporation, trust, joint venture, etc.

PROJECT LABORATORY. A temporary on-site facility providing concrete testing services for a specific project under the direction of a testing or branch laboratory licensed by the Commonwealth of Massachusetts.

TESTING AGENCY. National Institute of Standards and Technology (NIST), Cement and Concrete Reference Laboratory (CCRL), the Army Corps of Engineers or other agency designated by the BBRS.

TESTING LABORATORY. A proprietorship, corporation, partnership or agency which conforms to the requirements of ASTM E 329-72 as modified in 780 CMR 110.R1

110.R1.1.3 Licensing. All laboratories defined by 780 CMR 110.R1.1.2 as testing laboratories, branch laboratories and project laboratories which are engaged in the testing of concrete and concrete materials for use in buildings and structures subject to the construction control provisions of 780 CMR 116.0 will be licensed by the BBRS in accordance with 780 CMR 110.R1.

110.R1.1.4 Application for Licensing. Each laboratory desiring to obtain such license shall make application to the BBRS upon such form and in such manner as the BBRS shall prescribe and shall furnish evidence satisfactory to the BBRS that the

laboratory equipment meets the requirements of 780 CMR 110.R 1.2 and its management personnel are qualified in accordance with 780 CMR 110.R 1.4 and .5. Such application shall also include payment of the licensing fee set forth in 780 CMR 110.R1.1.8.

110.R1.1.5 Prequalifying Agency. The BBRS hereby designates the CMSB as its prequalifying agency, provided, however, that the BBRS may revoke such designation at any time, and may designate any other agency or agencies which it deems qualified, from time to time, to act as its prequalifying Agency. The prequalifying agency shall examine, or cause to be examined, the evaluation performed by the testing agency and the personnel on each Concrete Testing Laboratory application and make its recommendation to the BBRS regarding such license.

110.R1.1.6 Testing Agency. The BBRS hereby designates the Cement and Concrete Reference Laboratory of the National Institute of Standards and the Army Corps of Engineers as the agencies to examine and evaluate all laboratories desiring to be licensed in the practice of concrete testing, provided, however, that the BBRS may revoke such designation at any time, and may designate any other agency or agencies which it deems qualified, from time to time, to act as its testing agency.

110.R1.1.7 Notification of Testing and Testing Results. The testing agency shall notify the applicant of the date for evaluation and shall provide the audited laboratory with a report of audit findings.

Note: Unless specific permission has been granted by the BBRS, accredited laboratories must have the capability to test both concrete and concrete aggregate.

110.R1.1.7.1 Audit Findings Response. The audited laboratory shall request that the testing agency forward a copy of the audit report to the BBRS.

The audited laboratory shall prepare formal responses to each and all audit findings and issue such response report to the BBRS for review (also see 780 CMR 110.R1.3).

110.R1.1.8 Licensing Fee. The fee for licensing shall be \$150 *per annum* or in accordance with the fee schedule established by the BBRS from time to time.

110.R1.1.9 Number and Classification. Each laboratory so licensed by the BBRS shall be issued a number and classification.

110.R1.1.10 Renewals. Commencing January 1, 1978, all licenses issued shall expire on December 31st of the year issued. Within 60 days before the expiration date of any such license, the Administrator of the BBRS shall forward to each laboratory so licensed an application form for renewal. Said renewals shall be returned to the BBRS by December 31st. The said Administrator, upon receipt of the completed form and fee, shall renew the license for a period of one year or notify such applicant of the BBRS's refusal with reasons thereof.

110.R1.1.11 Penalties. Any such person and/or laboratory who fails to comply with the requirements of 780 CMR 110.R1 or who files a false report shall be subject to the penalties and actions as prescribed in the 780 CMR 118.0.

780 CMR 110.R1.2 LABORATORY LICENSING REQUIREMENTS

110.R1.2.1 ASTM Testing Requirements. Except as modified in 780 CMR 110.R1, all testing laboratories including branch laboratories shall conform to ASTM E 329-72, Sections 5 and 6, standard requirements for testing of concrete and its constituent materials.

Exception: The following sections of ASTM E 329-72 shall not apply:

Sections 2.2; 2.3; 2.7; 3.2.7; 3.3; 3.4 C360 of 6.2; 7; 8; 9 and 10.

110.R1.2.2 ASTM Equipment and Personnel Requirements. All laboratories subject to 780 CMR 110.R1 shall be approved and licensed in accordance with the ASTM E 329-72 standard for the performance of those functions recommended in standard ASTM E 329-72, for equipment and personnel, as modified in 780 CMR 110.R1.

780 CMR 110.R1.3 PREQUALIFICATION REQUIREMENTS FOR LABORATORIES

110.R1.3.1 Evaluation.

1. Testing and branch laboratories subject to 780 CMR 110.R1 shall be examined and evaluated, upon notification from the BBRS, by a testing agency designated by the BBRS. The interval between such examination and evaluation shall not exceed three years.
2. Project laboratory equipment which is used in the testing of concrete materials for use in buildings and structures subject to the provisions of 780 CMR shall conform to the requirements of ASTM E 329 as modified by 780 CMR 110.R1.2.
3. Reports of evaluations by the testing agency shall be filed with the BBRS within ten days of receipt of the report by the laboratory, unless a waiver is granted by the laboratory to have the report sent directly to the BBRS by the testing agency.

4. Laboratory deficiencies cited in the report of the testing agency shall be corrected within 30 days of the date of issue of the report and shall be so certified by an affidavit submitted by the laboratory on a form supplied by the BBRS.

110.R1.3.2 Review of Deficiencies. Laboratories which fail to meet the requirements of 780 CMR 110.R1 .3. Items 3. and 4. shall be subject to review and revocation of their license by the BBRS.

110.R1.3.3 Testing Machines. Compression testing machines used for testing materials subject to 780 CMR 110.R1 shall be calibrated and verified, with equipment traceable to the National Institute of Standards and Technology (NIST), at least annually or as required by the BBRS, and the results submitted to the BBRS.

780 CMR 110.R1.4 PERSONNEL

The management and supervision of each laboratory subject to 780 CMR 110.R1 shall be in accordance with the following requirements:

110.R1.4.1 Required. Each accredited licensed concrete testing laboratory must have an individual approved by the BBRS in each of three distinctly different categories: director of testing services, supervisory laboratory technician and supervisory field technician. An individual may fill more than one position at the particular laboratory if he or she meets all the qualifications for each position, but he or she may not fill positions concurrently at a separate (branch or project) laboratory. The project laboratory must have a full-time resident supervisory laboratory technician qualified in accordance with 780 CMR 110.R1.

110.R1.4.2 Filing of Qualifications. Each individual being certified for a position must submit his or her credentials and qualifications under penalty of perjury with signature notarized. Individuals applying for certification in more than one category must file separate applications for each position as described in 780 CMR 110.R 1.5. Application for certification shall be filed within 30 days of employment for such duties. It is the responsibility of the director of testing services to notify the BBRS within seven days of any vacancy of any position. Any vacant position shall be filled within 30 days.

780 CMR 110.R1.5 QUALIFICATIONS

110.R1.5.1 Qualifications for Director of Testing Services. The testing services of each laboratory (main, branch or project) shall be under the direction of a director of testing services who shall be a full-time resident employee of that laboratory and shall be qualified in accordance with anyone of the following three sets of requirements:

1. He or she shall be a professional engineer, registered in the Commonwealth of Massachusetts with a least five years of experience in responsible charge of work related to structural engineering, construction engineering or construction materials testing. He or she shall be subject to demonstrate his or her ability to interpret the results of tests of concrete and concrete aggregates as stated in ASTM E 329-72; or

2. He or she shall have a Bachelor's Degree in Engineering from an accredited institution and an additional total of three years of experience performing tests on concrete and concrete materials which shall include two years as a laboratory technician or supervisor. He or she shall be subject to demonstrate his or her ability to interpret the results of tests of concrete and concrete aggregates as stated in ASTM E 329-72; or

3. He or she shall have at least eight years experience including five years of experience as a laboratory technician or supervisor and shall be subject to demonstrate his or her ability to interpret the results of tests of concrete and concrete aggregates as stated in ASTM E 329-72.

110.R1.5.2 Qualifications for Supervisory Laboratory Technician. A supervisory laboratory technician shall have at least five years of experience performing tests on construction materials including concrete and concrete aggregates. He or she shall be subject to demonstrate his or her ability to perform correctly tests of concrete and aggregates as stated in ASTM E 329-72. "Class A" accreditation by the prequalifying agency shall be required as qualification for concrete only. (See 780 CMR 110.R2 *Concrete Testing Personnel Licensing*.)

110.R1.5.3 Qualifications for Supervisory Field Technician. A supervisory field technician shall have at least five years of experience performing tests on construction materials including concrete. He or she shall be subject to demonstrate either by oral or written examination, or both, his or her ability to perform correctly the tests of concrete as stated in ASTM E 329-72. "Class A" accreditation by the prequalifying agency shall be required as qualification for concrete only. (See 780 CMR 110.R2 *Concrete Testing Personnel Licensing*.)

780 CMR 110.R1.6 PROJECT AFFIDAVIT

In accordance with 780 CMR 110.12, those structures subject to control as required in 780 CMR 116.0, affidavits must be submitted with the building permit application that the individuals and testing laboratories responsible for carrying out the duties of 780 CMR 116.0 have been licensed and registered by the BBRS.

110.R1.6.1 Affidavit. In accordance with 780 CMR 110.R1.6, an affidavit shall be furnished to the building department by the licensed laboratory and

shall be provided by the licensed laboratory for each building project.

110.R1.6.2 Notice of Termination. The building official shall receive written notification of the termination of laboratory functions certifying that the owner has also been so notified. Such termination shall be effective no earlier than three working days from the notification received by the building official.

110.R1.6.3 Successor Laboratory. If concrete testing is to be continued for the said project by a successor laboratory, such notice shall be given to the building official and a new project affidavit shall be filed with the building official.

780 CMR 110.R1.7 REVOCATION AND SUSPENSION PROCEDURES

110.R1.7.1 Revocation and Suspension. The BBRS on its own initiative or upon the recommendation of the CMSB may suspend or revoke the license of any testing laboratory or project laboratory found to be in noncompliance with 780 CMR 110.R1, 780 CMR, or the standards of good practice. Notice of suspension or revocation of such license shall be in writing with the reasons for suspension or revocation clearly set forth therein, and served in accordance with the 780 CMR 118.6.

110.R1.7.2 Notice and Conference. Prior to suspension, revocation or refusal to renew the license of an accredited laboratory, written notice of such intent shall be served by the Construction Materials Safety Board of BBRS in accordance with 780 CMR 118.6. Within ten calendar days of receipt of such notice, the affected accredited laboratory may request a conference before a three-member panel designated by the chairman of the Construction Materials Safety Board; said panel will hear facts and make its recommendations to the CMSB, who in turn shall report such findings to the BBRS for BBRS consideration and action.

110.R1.7.3 Effect of Suspension or Revocation. Upon suspension or revocation of the license, the accredited laboratory shall immediately cease engaging in the testing of concrete and concrete materials for use in buildings and structures which are subject to the provisions of 780 CMR 116.0 and no action brought before the Board of Appeals as specified in 780 CMR 110.R1.8.1 or in any court of competent jurisdiction shall stay the said suspension or revocation unless said Board of Appeals or court shall issue an order for a stay of the BBRS's suspension or revocation.

780 CMR 110.R1.8 APPEALS

110.R1.8.1 Building Code Appeals Board. Any laboratory or individual aggrieved by the suspension or revocation of its license or by an interpretation, order, requirement, direction or failure to act under

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780 CMR 110.R1 may appeal to the State Building Code Appeals Board as provided in 780 CMR 122.0; however, entry of an appeal from the BBRS's order of revocation or suspension shall not stay such revocation or suspension unless so ordered by the

State Building Code Appeals Board in a preliminary hearing conducted expressly for the purpose of a stay in accordance with that part of 780 CMR 122.3.2 dealing with procedure required for a hearing on such stay.

780 CMR 110.R2

CONCRETE FIELD TESTING TECHNICIAN LICENSING

(Note: 780 CMR 110.R.2 is unique to Massachusetts)

780 CMR 110.R2.1 ADMINISTRATION

110.R2.1.1 Title. As authorized by M.G.L. c. 143, §§ 93 through 100, 780 CMR 110.R2 is adopted for Concrete Field Testing Technician.

110.R2.1.2 Definitions. Unless otherwise expressly stated in 780 CMR, the following terms, for the purpose of 780 CMR 110.R2, shall have the meaning indicated in 780 CMR 110.R2.1.2.

CONCRETE FIELD TESTING TECHNICIAN. A person issued a Grade 1 license by the American Concrete Institute (ACI) authorizing such person to test/inspect concrete.

TESTING AGENCY. Massachusetts Construction Industry Board (MCIB) or other official "local sponsoring group" of ACI.

110.R2.1.3 Licensing. All personnel engaged in field testing/inspection of concrete for use in buildings and structures subject to the construction control provisions of 780 CMR 116.0 shall be licensed by ACI as a Concrete Field Testing Technician - Grade 1 in accordance with ACI's

"Certification Policies for Concrete Field Testing Technician - Grade 1" and 780 CMR 110.R2.

110.R2.1.4 Application for Licensing. Applicants shall contact and follow the policies and procedures of the Testing Agency and ACI to be licensed in accordance with 780 CMR 110.R2.

110.R2.1.5 Examination. Applicants shall contact the Testing Agency regarding applications, fees and exam schedules. The exam includes a written and practical "hands-on" component.

110.R2.1.6 Notification of Examination and Examination Results. The testing agency provides the time and place for the examination. ACI provides exam results directly to the applicant.

110.R2.1.7 Fees. Application, testing and license fees are paid to the Testing Agency and/or ACI.

110.R2.1.8 Renewals. Licenses shall be renewed according to the policies of ACI.

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NON-TEXT PAGE

MANUFACTURED BUILDINGS, BUILDING COMPONENTS AND MOBILE HOMES

(Note: This Regulation is unique to Massachusetts)

PART I—GENERAL

780 CMR 110.R3.1 ADMINISTRATION

110.R3.1.1 Title. The BBRS, Massachusetts Board of Fire Prevention Regulations, Massachusetts Board of State Examiners of Electricians, and the Massachusetts Board of State Examiners of Plumbers and Gas Fitters herewith adopt the Rules and Regulations for Manufactured Buildings, Manufactured Building Components and Manufactured Homes.

110.R3.1.2 Definitions. Unless otherwise expressly stated in 780 CMR the following terms shall, for the purpose of 780 CMR 110.R3, have the meaning indicated in 780 CMR 110.R3.1.2.

APPROVAL. Approval by the State Board of Building Regulations and Standards (BBRS).

BUILDING SYSTEM. Plans, specifications and documentation for a system of manufactured buildings or for a type or a system of manufactured building components, which may include structural, electrical, mechanical, plumbing and fire protection systems and other systems affecting health and safety, including variations which are submitted as part of the building system.

CERTIFICATION. Any manufactured building, manufactured building component or manufactured home which meets the provisions of the applicable Codes and Rules and Regulations pursuant thereto; and which has been labeled accordingly.

CODE. 780 CMR or Specialized Codes as defined.

DEALER OF MODULAR HOMES. (For purposes of this definition, a modular home is a single or multiple, single-family residential manufactured building.) Any individual, organization or firm engaged in the retail selling, or offering for sale, brokering, or distribution of modular homes, primarily to a person who in good faith, purchases or leases such home for purposes other than resale. Such individual, organization or firm shall be registered with the Board of Building Regulations and Standards in accordance with policies established therefore.

DEPARTMENT - DPS. The Department of Public Safety, Division of Inspections.

INSPECTION AGENCY. Independent agency, sometimes referred to as "third-party agency," retained by the manufacturer and approved by BBRS to perform inspections and evaluations of building systems, compliance assurance programs,

manufactured buildings, and manufactured building components.

INSTALLATION. The process of affixing, or assembling and affixing a manufactured building, manufactured building component or manufactured home on the building site, and connecting it to utilities, and/or to an existing building. Installation may also mean the connecting of two or more manufactured housing units designed and approved to be so connected for use as a dwelling.

INSTALLER OF MANUFACTURED BUILDINGS. An individual who, on the basis of training and experience, has been certified by a specific manufacturer of manufactured homes as competent to supervise the placement and connection required to install the manufactured homes of that manufacturer. Said certification by the manufacturer shall be in writing; additionally, the certified installer shall possess picture identification in the form of a driver's license or other picture identification acceptable to the building official in accordance with the *Sixth Edition of the Massachusetts State Building Code*, 780 CMR 108.3.5.1.

LABEL. An approved device or seal evidencing certification in accordance with the applicable Codes and Rules and Regulations promulgated pursuant thereto.

LOCAL ENFORCEMENT AGENCY. A department or agency in a municipality charged with the enforcement of 780 CMR and appropriate specialized codes which include, but are not limited to, 248 CMR (the State Plumbing and Gas Fitting code) and 527 CMR 12.00 (the State Electrical Code).

MANUFACTURED BUILDING. Any manufactured building which has concealed elements, such as electrical, mechanical, plumbing, fire protection, insulation, and other systems affecting health and safety, and which is manufactured or assembled in accordance with 780 CMR and pertinent regulations, in manufacturing facilities, on or off the building site. Also, any manufactured building as defined above which does not have concealed elements, but which has been approved by the BBRS at the request of the manufacturer. "Manufactured building" does not mean "manufactured home."

MANUFACTURED BUILDING COMPONENT. Any manufactured subsystem, manufactured subassembly, or other system designed for use in or as part of a structure having concealed elements such as electrical, mechanical,

plumbing and fire protection systems and other systems affecting health and safety.

MANUFACTURED HOMES (Housing). As defined in 24 CFR, Part 3280.2; a structure, transportable in one or more sections, which in the traveling mode, is eight body feet or more in width or forty body feet or more in length, or, when erected on site, is 320 or more square feet, and which is built on a permanent chassis and designed to be used as a dwelling with or without a permanent foundation when connected to the required utilities, and includes the plumbing, heating, air-conditioning, and electrical systems contained therein. Calculations used to determine the number of square feet in a structure will be based on the structure's exterior dimensions measured at the largest horizontal projections when erected on site. These dimensions will include all expandable rooms, cabinets, and other projections containing interior space, but do not include bay windows. (See 24 CFR, Part 3280.2 for a more detailed description of manufactured homes as defined by the Department of Housing and Urban Development.)

RECERTIFIED MANUFACTURED BUILDING. Any manufactured building as herein defined that was previously designed and constructed to conform with requirements of a particular use group or groups for use at a site and that subsequently is to be relocated to a different site. Such buildings, also known as relocatable units, shall be inspected by the responsible third-party inspection agency and recertified in accordance with 780 CMR and 780 CMR 110.R3 as applicable to ensure compliance with the new use group or groups if such use group or groups has changed or to requirements of the original use group or groups if not changed prior to being set at the new location.

SPECIALIZED CODE. All building codes, rules or regulations pertaining to building construction, reconstruction, alteration, repair or demolition promulgated by and under the authority of the various agencies which have been authorized from time to time by the General Court of the Commonwealth of Massachusetts. The specialized codes shall include, but not be limited to, 248 CMR (the State Plumbing and Gas Fitting Code) and 527 CMR 12.00 (the Electrical Code).

STATE ADMINISTRATIVE AGENCIES. Boards, commissions, departments or agencies authorized to promulgate, adopt and amend codes and rules and regulations relating to buildings and structures and parts thereof and limited to the BBRS, Massachusetts Board of Fire Prevention Regulations, Massachusetts State Examiners of Electricians, and the Massachusetts Board of State Examiners of Plumbers and Gas Fitters.

STATE ENFORCEMENT AGENCIES. Boards, commissions, departments or agencies authorized to enforce the provisions of the codes and rules and regulations which have been promulgated, adopted and amended and which relate to buildings or structures and parts thereof and limited to the Department of Public Safety, Massachusetts Board of State Examiners of Plumbers and Gas Fitters, and the Massachusetts State Examiners of Electricians.

110.R3.1.3 Scope.

1. 780 CMR 110.R3 shall govern the design, manufacture, handling, storage, transportation and installation of manufactured buildings, and manufactured building components intended for installation in this State and/or manufactured in this State for shipment to any other state in which such building, building components, or manufactured homes and the labels thereon are accepted.

2. The Federal Manufactured Home Construction and Safety Standards promulgated by the Department of Housing and Urban Development govern the design, manufacture, handling, storage and transportation of manufactured homes for installation in this state.

3. Subject to local zoning ordinances and by-laws, manufactured buildings, manufactured building components or manufactured homes may be sold for, delivered to, or installed on, building sites located in any jurisdiction of this State if such buildings, building components or manufactured homes have been approved and certified pursuant to the applicable Codes and 780 CMR 110.R3.

110.R3.1.4 Administration and Enforcement. The BBRS and the State Enforcement Agencies shall enforce all provisions of 780 CMR 110.R3. The State Enforcement Agencies and the Local Enforcement Agencies shall have the responsibility for evaluating building systems and performing inspections of manufactured buildings and manufactured building components to enforce compliance with 780 CMR 110.R3 and the applicable codes. The State Enforcement Agencies and the local enforcement agencies shall deem acceptable manufactured buildings, manufactured building components, building systems and compliance assurance programs labeled and certified by inspection agencies approved by the BBRS and those manufactured homes certified as in conformance with the Federal standards by the application of the applicable required HUD label.

110.R3.1.5 Authorization of Third-party Inspections. Upon recommendation of the State Enforcement Agencies, the BBRS may authorize inspection agencies, sometimes referred to as third party inspection agencies, to perform all or part of the inspection and certification of manufactured

buildings and manufactured building components, building systems and compliance assurance programs, including either or both the issuance and the attachment of labels thereto. The BBRS may suspend or revoke such authorization for cause.

110.R3.1.6 Approvals and Compliance. Upon the recommendation of the State Enforcement Agencies, the BBRS may approve building systems and compliance assurance programs which comply with the codes, standards, specifications, requirements and 780 CMR 110.R3.

110.R3.1.7 Time of Manufacture. For purposes of 780 CMR 110.R3, a manufactured building, manufactured building component or manufactured home is deemed to be manufactured at such time as the label as herein described is duly issued label is attached to it in accordance with the approved compliance assurance program.

110.R3.1.8 Retroactive Changes. No changes in the codes, standards, specifications and requirements of 780 CMR 110.R3 shall apply retroactively.

110.R3.1.9 Amendments. The State Administrative Agencies shall notify the BBRS, and the BBRS shall notify all interested parties including State Enforcement Agencies, inspection agencies, manufacturers with approved building systems, and local governmental jurisdictions of all amendments to 780 CMR 110.R3, and each manufacturer shall have no more than 180 days following the sending of notification to submit to the BBRS compliance assurance program revisions in order to comply with such amendments. Where imminent danger to life safety is involved, the State Administrative Agencies may require that immediate effect be given such amendments to the codes, standards, specifications and requirements so adopted.

780 CMR 110.R3.2 COMPLIANCE ASSURANCE PROGRAMS

110.R3.2.1 Approval. In order to obtain approval for manufactured buildings or manufactured building components a manufacturer shall submit a building system for evaluation to the BBRS for approvals in accordance with 780 CMR 110.R3.

110.R3.2.2 Suitability. Prior to a full evaluation, the State Enforcement Agencies shall determine that building systems and/or the application for approval of the compliance assurance program submitted to it are suitable for processing. In the event that the application is found to be unsuitable for processing, the applicant shall be notified in writing of such unsuitability and the basis thereof, within 30 days of the date the application is received by the BBRS. In such event, all but \$25.00 of the fee will be returned and the findings of unsuitability will be without prejudice. Any subsequent submission shall be treated as a new application.

110.R3.2.3 Requisites. The State Enforcement

Agencies may require tests to determine whether a compliance assurance program meets the codes, standards and requirements of the evaluation of plans, specifications and documentation. The procedures used shall be reviewed and evaluated by the BBRS in accordance with 780 CMR 110.R3. The costs of such tests shall be borne by the applicant.

110.R3.2.4 Notification of Disapproval. In the event a compliance assurance program is disapproved by the BBRS, the BBRS shall notify the applicant with a written explanation of the reasons for such disapproval thereto.

110.R3.2.5 Approval – Evidence. Approval of a compliance assurance program shall be evidenced by a letter of certification issued by the BBRS.

110.R3.2.6 Approval – Report. The State Enforcement Agencies shall prepare and the BBRS shall issue to the applicant a building system approval report which shall include therein any conditions imposed for its use.

110.R3.2.7 Approval – Variations. A building system and compliance assurance program or any amendment there to which has been approved, shall not be varied in any way without prior written authorization by the BBRS. All amendments shall be in writing and shall be made a part of the written record of the approval.

110.R3.2.8 Amendments – Proposed. Amendments to compliance assurance programs may be proposed by submitting to the BBRS for its approval, appropriate plans, specifications, or documentation showing the effect of the proposed amendment on each building system and the required fee.

110.R3.2.9 Compliance Assurance Program. A manufacturer shall obtain approval from the BBRS of a compliance assurance program for his building system. Buildings or building components shall be manufactured in accordance with an approved program in order to be certified. Compliance assurance programs shall be submitted to the BBRS for its approval in accordance with 780 CMR 110.R3.

780 CMR 110.R3.3 CERTIFICATION

Manufactured buildings or manufactured building components or manufactured homes, accepted by the State Enforcement Agencies and an inspection agency as having been manufactured according to an approved building system and an approved compliance assurance program, shall be certified by the BBRS upon the recommendation of the State Enforcement Agencies as complying with the requirements of the applicable codes and 780 CMR 110.R3. Certification shall be evidenced by the issuance of a label by the Board of Building

Regulations and Standards and by attachment of the label to each certified manufactured building or manufactured building component (or groups of components).

110.R3.3.1 Manufacturer's Data Plate.

110.R3.3.1.1 Contents. The following information shall be placed directly or by reference on one or more permanent manufacturer's data plates in the vicinity of the electrical distribution panel, or in some other designated location acceptable to the State Enforcement Agencies, on the manufactured building or manufactured building component where it will be readily accessible for inspection.

1. Manufacturer's name and address;
2. Serial number of the unit;
3. Label serial number;
4. Name and date of applicable building, plumbing, gas and electrical codes and issue of their accumulative supplements complied with;
5. Model designation and name of manufacturer of major factory-installed appliances;
6. Identification of permissible type of gas for appliance and directions for water and drain connection;
7. Snow, wind, seismic and other live loads;
8. Electrical ratings - instructions and warnings on voltage;
9. Special conditions or limitations on use of the units, including unsuitability for areas in which specified environmental conditions prevail;
10. Methods of assembly or joining multiple units;
11. Type of construction, including fire rating, occupancy class, and interior finish flame spread class;
12. Building height and story limitation;
13. Floor area; and
14. Minimum side yard requirements for fire rating.

If, in the opinion of the State Administrative Agencies, the shape or size of a building component is such that this information cannot be attached to it permanently, the information may be placed in a manual crated with the component or on a tag attached to the crate in which the component is shipped, if the information is not such that the future occupant of the building should know it. If the occupant will need to know the information, it shall be contained in a manual which shall be presented to the occupant upon transfer of possession. If life safety is involved, the item in question shall be plainly labeled.

110.R3.3.2 Labels. Each manufactured building or manufactured building component which is certified pursuant to the applicable codes and 780 CMR 110.R3, shall have permanently attached thereto, in

a visible location as shown on the approved building system, an approved label which cannot be removed therefrom without destroying such label. Said label shall be made part of the permanent record for the manufactured building or manufactured building component, copies of which shall be retained by the manufacturer, the BBRS and the municipal and/or state building department where the manufactured building product is installed. Manufactured building that are to be used as a re-locatable unit, shall be issued a new label upon submission of a new Third Party Inspection Agency Compliance Report in attestation that the re-locatable unit has been inspected and meets the requirements of all applicable Massachusetts codes and requirements of 780 CMR 110.R3.

110.R3.3.2.1 Contents. An approved label shall bear the following information.

1. The statement "This label certifies that this building (or building component) has been manufactured in accordance with an approved building system and compliance assurance program which has been approved by the Commonwealth of Massachusetts Board of Building Regulations and Standards. Said manufactured building or manufactured building component has been inspected by

Name of Third-Party Inspection Agency

Name of Third-Party Inspector

- a. Label serial number.
- b. Building system approval number.
- c. Manufacturer's serial number.
- d. The words "See data plate located on."
- f. Date of manufacture.

At the direction of the BBRS labels and data plates may be limited in size and content for components whose shape and size does not permit the full information to be placed thereon.

110.R3.3.2.2 Issuance of Labels. The approved label shall be issued by the BBRS in accordance with the following.

1. If the BBRS delegated the issuance of labels to an inspection agency, the agency shall be required to obtain approval from the BBRS for the manner in which they are handled;
2. Labels must be serially numbered;
3. A manufacturer's compliance assurance program submitted in accordance with 780 CMR 110.R3 shall include requirements for issuance, possession of, attachment of, and accounting for all labels to assure that labels are attached only to manufactured buildings, manufactured building components, or manufactured homes manufactured pursuant to

an approved building system and inspected pursuant to an approved compliance assurance program; and

4. Upon request of the inspection agency, the BBRS may determine that the manufacturer's record of compliance is such that the inspection agency need not maintain an inspector in a given plant at all times, inspection agency may entrust labels to the custody of one or more employees of the manufacturer, who shall be charged with controlling the use of the such labels. Such employees shall not be given custody of more labels than are necessary. If the conditions of custody are violated, the BBRS or an inspection agency shall immediately regain possession of all labels that have not been applied to the manufactured buildings or manufactured building components and shall take such further action with respect to future labeling, as it may deem necessary to assure compliance with the applicable codes and 780 CMR 110.R3.

110.R3.3.3 Records of Labels. Permanent records shall be kept of the handling of all labels, indicating at least how many labels have been applied issued to manufacturers for their to manufactured buildings or manufactured building components (or groups of components), and which labels have been applied assigned to which buildings or building components, the disposition of any damaged or rejected labels, and the location and custody of all unused labels. Such records shall be maintained by the manufacturer or by the inspection agency and a copy of such records covering attachment of each label shall be sent to the Board of Building Regulations and Standards on the tenth of each month and the BBRS shall forward all such records to the State Enforcement Agencies.

110.R3.3.4 Attachment of Labels. The inspection agency shall attach in numerical sequence labels to manufactured buildings or manufactured building components manufactured in accordance with an approved building system and meeting the requirements of an approved compliance assurance program.

Manufacturers shall attach labels in the same manner to manufactured buildings or building components manufactured in accordance with an approved building system and meeting the requirements of an approved compliance assurance program.

Manufacturers shall attach labels in the same manner to manufactured buildings or building components manufactured in accordance with a approved compliance assurance program, if custody of the labels has been entrusted to them in accordance with 780 CMR 110.R3.3.3.4.

110.R3.3.5 Suspension and Revocation. The BBRS may suspend or revoke, or cause to be

suspended or revoked, the certification of any manufactured building or manufactured building component which the State Enforcement Agencies or an inspection agency finds not to comply with the applicable codes or 780 CMR 110.R3, or which has been manufactured pursuant to a building system or a compliance assurance program for which approval has been suspended or revoked, or which has not been manufactured in accordance with the approved compliance assurance program. The State Enforcement Agencies shall withhold or void a label or shall remove or cause to be removed, labels from any such manufactured building, manufactured building component or manufactured home until it is brought into compliance with the applicable codes and 780 CMR 110.R3. Notice of suspension or revocation of certification shall be in writing with the reasons for suspension or revocation clearly set forth therein.

1. Upon suspension or revocation of the approval of any building system or compliance assurance program, no further labels shall be issued, assigned and/or attached to any manufactured buildings or manufactured building components manufactured pursuant to the building system or compliance assurance program with respect to which the approval was suspended or revoked. Upon termination of such suspension or revocation, labels may again be issued and/or assigned be attached to the manufactured building or manufactured building components manufactured after the date approval was reinstated. Should any building or building component have been manufactured during the period of suspension or revocation, it shall not be issued a label unless the State Enforcement Agencies or inspection agency have inspected such building or building component and is satisfied that all requirements for certification have been met. If the State Enforcement Agency acts under 780 CMR 110.R3.3.5, it must notify the inspection agency.

2. The manufacturer shall return all labels allocated for a manufactured building or manufactured building component to the BBRS no later than 30 days from the effective date of any suspension or revocation of the State Enforcement Agencies or inspection agency, of the building system or compliance assurance program pursuant to which the manufactured building or manufactured building component is being manufactured. The manufacturer shall also return to the BBRS all labels which it determines for any reason are no longer needed.

110.R3.3.6 Variations of Certified Units. Manufactured buildings, manufactured building components or manufactured homes certified and labeled pursuant to the applicable codes and 780 CMR 110. R3 shall not be varied in any way prior to the issuance of a certificate of occupancy

without resubmission to the BBRS for its approval of the variation and of the unit which includes the variation. The State Enforcement Agencies, Local Enforcement Agencies or an inspection agency shall inspect the manufactured building, manufactured building component or manufactured home wherever it is located and such inspection may include such tests or destructive or nondestructive disassembly as the State Enforcement Agencies or an inspection agency deems necessary to assure compliance with the applicable Codes and 780 CMR 110.R3. Local Enforcement Agencies may be designated by the BBRS or State Enforcement Agencies as inspection agencies for such purposes.

780 CMR 110.R3.4 INSPECTION BY THE STATE ENFORCEMENT AGENCIES OR THEIR AGENTS

The State Enforcement Agencies shall make, or cause to be made, such inspections of the entire processing of manufacturing, certifying, handling, storing and transporting of manufactured buildings or manufactured building components produced pursuant to approved building systems as they deem necessary.

110.R3.4.1 Inspection of Facilities. As part of the process of evaluating building systems and compliance assurance programs, the State Enforcement Agencies shall inspect, or cause to be inspected, the manufacturing facilities in which the buildings or building components are to be manufactured.

110.R3.4.2 Inspection According to Compliance Assurance Programs. The State Enforcement Agencies or an inspection agency shall make such inspections as may be required by an approved compliance assurance program, or as may be deemed necessary by the State Enforcement Agencies.

110.R3.4.3 Inspection of Damaged Components. Prior to the issuance of a certificate of occupancy, the State Enforcement Agencies or an inspection agency shall inspect, or cause to be inspected, certified manufactured buildings or manufactured building components which it determines to have been sufficiently damaged after certification to warrant such inspection and to take such action with regard to such buildings or building components as is authorized hereof, or as is otherwise necessary to eliminate dangerous conditions. The local enforcement agencies may be designated by the BBRS or the State Enforcement Agencies as the inspection agency.

110.R3.4.3.1 Repairing Damaged Components. The State Enforcement Agencies or an inspection agency shall require manufactured buildings or manufactured building components which are so damaged as to no longer comply with the applicable Codes and 780 CMR 110.R3 to be

repaired and made to comply within a reasonable time; or if they are so damaged that they cannot be brought into compliance, the State Enforcement Agencies or inspection agency shall order that the labels be removed voided for from such buildings, building components or manufactured homes. A report under 780 CMR 110.R3.4 shall be filed with the inspection agency, BBRS and State Enforcement Agency.

110.R3.4.3.2 Irreparably Damaged Components. Irreparably damaged buildings or building components shall be disposed of by the manufacturer.

110.R3.4.4 Monitoring Inspection Agency. The State Enforcement Agencies or their designated agents shall examine each approved inspection agency, at any reasonable time, and without prior announcement, in order to monitor the reliability of each agency and of its monitoring of each compliance assurance program. Each such examination shall investigate the adequacy of all procedures used by the agency in monitoring compliance assurance programs including inspection, tests, production methods, process controls, operator performance, materials, receipts, storage and handling, workmanship standards, records and all other activities which implement the compliance assurance program in the manufacturing facility, during transport, on-site, and at critical subcontractors' facilities. The results of such examinations shall be filed with the office of the BBRS. Copies of such reports shall be sent to the inspection agency and the State Enforcement Agencies. Inspection agencies shall be specifically notified by the BBRS of any deficiencies and of the manner and time by which such deficiencies must be eliminated. If deemed necessary by the State Enforcement Agencies, an inspection agency's approval may be suspended or revoked by the BBRS as provided.

110.R3.4.4.1 Prior to Approval. Such examinations may also be conducted before approving an inspection agency.

110.R3.4.5 Inspection by Disassembly. No inspection entailing disassembly, damage to or destruction of certified manufactured buildings, manufactured building components or manufactured homes shall be conducted except to implement 780 CMR 110.R3.

780 CMR 110.R3.5 LOCAL ENFORCEMENT AGENCY PROCEDURES AND INSPECTIONS

110.R3.5.1 Issuance of Building Permits. Upon application and in conformity with the provisions of 780 CMR, the building official shall issue building permits for installation of certified manufactured buildings, manufactured building components or manufactured housing.

110.R3.5.1.1 Licensed Construction

Supervisors and Certified Installers. A construction supervisor, duly licensed in accordance with 780 CMR 110.R5, shall, in accordance with the *Sixth Edition of the Massachusetts State Building Code*, 780 CMR 108.3.5, act as the agent for the owner for the purpose of applying for and obtaining any and all building permits required for the field erection of all one or two family manufactured dwellings subject to the provisions of 780 CMR and 780 CMR 110.R3 as applicable.

As part of the building permit application process, the licensed construction supervisor shall submit to the building official, in writing, the name of the installer, who shall be duly certified by the manufacturer to install said manufacturer's product, and is identified as a *certified installer of manufactured buildings* (certified installer) by said manufacturer. The certified installer shall be responsible for the safe and proper placement and connection of the manufactured home units in accordance with 780 CMR, 780 CMR 110.R3 and the specialized codes as listed in 780 CMR 100.00 under *CMR*.

The licensed construction supervisor shall be responsible for the construction of the foundation system, and all pertinent site work, in accordance with 780 CMR and 780 CMR 110.R3. The licensed construction supervisor shall provide at least 48 hours notice to the BBRS and the local building official before the placement and connection of such units shall begin. An application to local enforcement agencies for an appropriate permit shall, in addition to any other requirements, contain the following information.

110.R3.5.1.2 Permit Application—Statement of Content. A statement that the work to be performed under such permit is to include the installation of a certified manufactured building, manufactured building component or manufactured home in accordance with the provisions of the applicable codes, the statement is to be signed by the applicant or his agent, with the appropriate address.

110.R3.5.1.3 Permit Application – Building System. A true copy of the approved building system with respect to which the manufactured building or manufactured building component was manufactured or is to be manufactured, where one has not previously been furnished to that local enforcement agency.

110.R3.5.1.4 Permit Application – Building System Approval. A copy of the Building System Report, as approved by the BBRS, where it has not previously been furnished to the Local Enforcement Agency.

110.R3.5.2 Inspection of Site Preparation and Service Connections. Appropriate local enforcement agencies shall inspect site preparation work including foundations, not within the scope of

the approval and certification, and the structural, mechanical, plumbing and electrical connections among units, for compliance with applicable law, rules and regulations.

110.R3.5.3 Compliance with Instructions. Appropriate local enforcement agencies shall inspect all manufactured buildings, manufactured building components or manufactured homes upon, or promptly after, installation at the building site to determine whether all instructions in the Building System Approval Report or conditions listed on the manufacturer's data plate have been followed.

This may include tests for tightness of plumbing and mechanical systems, and for malfunctions in the electrical system and a visual inspection for obvious nonconformity with the approved building system.

110.R3.5.3.1 Disassembly Prohibited.

Unauthorized destructive disassembly of certified buildings and building components and mobile homes shall not be performed in order to conduct such tests or inspections, except as provided in 780 CMR 110.R3.3.4.3, nor shall there be imposed standards or test criteria different from those adopted by the State Enforcement Agencies or specified in the Building System Approval Report, or the "HUD's" Manufactured Home Construction and Safety Standards.

110.R3.5.3.2 Opening Panels. Nondestructive disassembly may be performed only to the extent of opening access panels and cover plates.

110.R3.5.4 Noncomplying New Units. Local enforcement agencies shall report to the BBRS in accordance with 780 CMR 110.R3.5.6 any non-complying manufactured buildings and building components.

110.R3.5.5 Certificates of Occupancy.

Appropriate local inspectors shall issue certificates of occupancy for certified manufactured buildings and manufactured homes containing certified building components which otherwise comply with all the applicable codes, after they have been installed and inspected pursuant to the applicable codes and 780 CMR 110.R3, provided that any manufactured building or manufactured building component found not to comply with the Building System Approval Report or any manufactured home found not to comply with "HUD's" Manufactured Home Construction and Safety Standards shall be brought into compliance before such certificate of occupancy shall be issued.

110.R3.5.6 Reporting of violations to department of public safety. When any local enforcement agency is making an inspection and finds violations or suspected violations, it shall report the details of the violations in writing to the BBRS. Where violations are hazardous to occupants, a certificate of occupancy shall not be issued and the building shall not be occupied before such hazards are corrected.

If the violations are not hazardous, a temporary certificate of occupancy may be issued.

780 CMR 110.R3.6 FEES

110.R3.6.1 Deposit for Application to the BBRS. A deposit shall be required upon application to the BBRS to perform any of the functions in 780 CMR 110.R3.

110.R3.6.2 Establishment of Fees. Fees charged by the BBRS for functions performed shall be in accordance with the fee schedule established by the State Administrative Agencies as specified in 780 CMR 110.R3.18.

780 CMR 110.R3.7 NOTIFICATION OF CHANGES IN NAME, ADDRESS, OWNERSHIP OR LOCATION

110.R3.7.1 Notification by Manufacturers. Manufacturers shall notify the BBRS in writing within ten days of any of the following occurrences:

1. The corporate name is changed;
2. The main address of the company is changed;
3. There is a change in 25% or more of the ownership interest of the company within a 12-month period;
4. The location of any manufacturing facility is changed;
5. A new manufacturing facility is established; or
6. There are changes in principal officers of the firm.

The BBRS shall notify the State Administrative Agencies of such occurrences.

110.R3.7.2 Notification by Inspection Agencies. Inspection agencies shall notify the BBRS in writing within ten days of any of the following occurrences.

1. The company name is changed;
2. The main address of the company is changed;
3. There is a change in 25% or more of the ownership interest or control of the company within a 12-month period;
4. The location of any testing facility is changed;
5. A new testing facility is established; or
6. There are changes in principal officers and key supervisory and responsible personnel of the firm.

The BBRS shall notify the State Administrative Agencies of such occurrences.

780 CMR 110.R3.8 PROPRIETARY INFORMATION

All information relating to building systems and compliance assurance programs which the manufacturer or other party considers proprietary shall be so designated by him at the time of its submission, and shall be so held by the State Enforcement Agencies and State Administrative Agencies, except as the State Administrative Agencies determine in each case, that disclosure is necessary to carry out the purposes of the applicable

codes and 780 CMR 110.R3.

PART II—REQUIREMENTS FOR SUBMISSION OF BUILDING SYSTEMS AND COMPLIANCE ASSURANCE PROGRAMS

780 CMR 110.R3.9 BUILDING SYSTEMS

Building systems shall meet the requirements set forth below to be evaluated for compliance with the standards, specifications and requirements adopted by the State Administrative Agencies.

110.R3.9.1 General Requirements.

110.R3.9.1.1 Plans, Specifications and Documentation. Building systems, including all plans, specifications and other documentation, shall be submitted in quadruplicate to the BBRS who shall act as the depository and disbursing agent of all such items. The BBRS shall forward to the appropriate State Enforcement Agencies plans, specifications and documentation for their recommendations.

110.R3.9.1.2 Form and Fees. Building systems shall be submitted in the form prescribed by the BBRS and shall be accompanied by all required fees.

110.R3.9.1.3 Identification. All documents submitted with the application shall be identified to indicate the manufacturer's name, office address and address of the manufacturing facility.

110.R3.9.1.4 Plans Showing Elements. Plans shall be submitted showing all elements relating to specific systems on properly identifiable sheets.

110.R3.9.1.5 Application—Approved Architect or Engineer. Each building system application shall bear the signature and seal of an approved registered architect or registered professional engineer certifying that the building system complies with the applicable codes and standards promulgated herein.

110.R3.9.1.6 On-site Work Identified. All work to be performed on-site, including connection of all systems, equipment and appliances, shall be identified and distinguished from work to be performed in the manufacturing facility.

110.R3.9.1.7 Space for State Administrative Agencies Approval Stamp. A three inch x four inch blank rectangular space shall be provided on all sheets of plans near the title box for the BBRS's stamp of approval.

110.R3.9.1.8 Material Grade and Quality. Grade, quality and identification of all material shall be specified.

110.R3.9.1.9 Calculations and Test Reports. Design calculations and test reports shall be specified.

110.R3.9.1.9.1 Drawings to Scale. Drawings shall be drawn to scale and be legible.

110.R3.9.1.9.2 Label and Data Plate

Location. Drawings shall indicate the location of the data plate.

110.R3.9.1.9.3 Drawings Dated and Identified.

Drawings shall be dated and identified. The number of sheets in each set shall be indicated.

110.R3.9.2 Required Construction Details.

Building systems for manufactured buildings shall provide or show, but not be limited to, the details listed below including the method of their testing or evaluation, or both. These requirements shall apply to the building systems for building components only to the extent deemed necessary by the State Enforcement Agencies to permit a proper evaluation of the building component.

110.R3.9.2.1 General.

1. Details and methods of installation of manufactured buildings or manufactured building components on foundations and/or to each other.
2. All exterior elevations.
3. Cross sections as necessary to identify major building components.
4. Details of flashing, such as at openings and at penetrations through roofs and subcomponent connections. Indicate flashing material and gauge to be used.
5. Attic access and attic ventilation.
6. Exterior wall, roof and soffit material as well as finish.
7. Interior wall and ceiling finish material.
8. Fire separation walls.
9. Sizes, locations and types of doors, windows and fire/smoke detectors.
10. Recommended foundation plans, vents and underfloor access.

110.R3.9.2.2 Building Classification.

1. Occupancy or use.
2. Area, height, and number of stories.
3. Type of construction.
4. Fire resistance ratings.

110.R3.9.2.3 Space and Fire Safety.

1. Details of fire resistance rated assemblies for all stairway enclosures, doors, walls, floors, ceilings, partitions, columns, roof and shaft enclosures.
2. Detail of Fire Protection Systems.
3. Details as to width of all aisles, exits, corridors, passageways and stairway enclosures.
4. Toxicity and flame spread classification of finished materials.

110.R3.9.2.4 Structural Detail Requirements.

1. Engineer's calculations of structural members, where appropriate.
2. Structural and framing details of all floors,

roof and walls.

3. Details and stress diagrams of roof trusses.
4. Details of reinforcing steel.
5. Complete loading schedule.
6. Column loads and column schedule.
7. Lintel schedule.
8. Size, spacing and details of all structural elements.
9. Grade or quality of all structural elements (lumber, steel, etc.).
10. Elevation of structural elements, walls or sections thereof, providing resistance to vertical loads or lateral forces.
11. Complete details of all structural connections.

110.R3.9.2.5 Mechanical Detail Requirements.

1. Location of all equipment and appliances. Indicate equipment and appliances listed or labeled by approved agencies.
2. Heat loss and heat gain calculations.
3. Manufacturer's name, make, model, number, BTU, input and output rating of all equipment and appliances, as appropriate, or the equal thereof.
4. Duct and register locations, sizes, and materials.
5. Clearances from combustible material or surfaces for all ducts, flues and chimneys.
6. Method of providing required combustion air and return air.
7. Location of flues, vents and chimneys and clearances from air intakes and other vents and flues.
8. Details regarding dampers in ducts penetrating fire separations.
9. Complete drawings of fire sprinkler system, standpipe system or smoke/fire alarm system as required.
10. Detail of elevator or escalator system, including method of emergency operation.
11. Duct and piping insulation thickness.
12. Ventilation air calculations.

110.R3.9.2.6 Plumbing Detail Requirements.

1. Plan or schematic drawing of the plumbing layout, including but not limited to, size of piping, fitting, traps and vents, cleanouts and valves, gas, water, and drainage system.
2. Plumbing materials, and location of all equipment and appliances to be used. Indicate fixture unit capacity of system(s) and the make, model, and rating/capacity of equipment and appliances. Indicate equipment and appliances listed or labeled by approved agencies.
3. Make and model of safety controls (such as for water heaters), their location, and whether listed or labeled by approved agencies.
4. How piping is to be supported and intervals of support.

5. Location of vents above roofs and required clearances, including but not limited to clearances from air intakes, other vents and flues.
6. Methods of testing.

110.R3.9.2.7 Electrical Detail Requirements.

1. Plan of service equipment, including service entrance, conductors, service raceway and clearances above ground and above structures.
2. Method and detail for grounding service equipment.
3. Single line diagram of the entire electrical installation.
4. Load calculations for service and feeders.
5. Sizes of all feeders and branch circuits.
6. Size, rating and location of main disconnect/overcurrent protective devices.
7. Method of interconnection between manufactured buildings or manufactured building components and location of connections.
8. Location of all outlets and junction boxes.
9. i. Method of mounting fixtures and wiring installations.
10. Lighting power calculations.

780 CMR 110.R3.10 COMPLIANCE ASSURANCE PROGRAMS FOR MANUFACTURED BUILDINGS AND MANUFACTURED BUILDING COMPONENTS

Compliance assurance programs shall be approved if they meet the requirements set forth in 780 CMR 110.R3.10. It is the manufacturer's responsibility to execute every aspect of this program. The manufacturer shall continue to be responsible for all corrective actions required and the contractual relationship between the manufacturer and the inspection agency shall not diminish such responsibility. The manufacturer shall cooperate with the inspection agency by providing the inspection agency with all necessary reports, information, documents, records, facilities, equipment, samples and other assistance for assuring compliance.

The manufacturer's compliance assurance program shall be submitted to the BBRS in the form of a compliance assurance manual which shall contain complete documentation of all compliance assurance activities of both the manufacturer and the inspection agency. The manual shall be comprehensively indexed, and shall treat the material listed here in detail, as follows.

110.R3.10.1 Organization Requirements.

1. A procedure for periodic revision of the manual;
2. An organizational structure for implementing and maintaining the compliance assurance

program and its functional relationship to other elements of the organization structure of the manufacturer, which structure shall provide for independence from the production department; Company officers and employees in charge of the compliance assurances program must be identified, and their training and qualifications specified;

3. A uniform system of audit (in-depth analysis of program effectiveness and means to identify deficiencies) to monitor program performance periodically;

4. Complete and reliable records of manufacturing and site operations, if any (suitable means of storage, preservation and accessibility of copies of forms to be utilized shall be included);

5. A system to control changes in production or inspection procedures;

6. A system to assure that working drawings and specifications, working instructions and standards, procurement documents, etc. conform to the approved building system;

7. A serial number system for buildings or building components; and

8. The method of safekeeping, handling and attaching labels and identification of those employees responsible therefor.

110.R3.10.2 Materials Control.

1. Procedure to assure effective control over procurement sources to ensure that materials, supplies and other items used in production and site operations, if any, conform to the approved plans, specifications and quality requirements;

2. Procedures for inspection of materials, supplies and other items at the point of receipt;

3. Method of protection of materials, supplies and other items against deterioration prior to their incorporation in the certified buildings or building component; and

4. Provision for disposal of rejected materials, supplies and other items.

110.R3.10.3 Production Control.

1. Procedures for timely remedial and preventive measures to assure product quality;

2. Provision, maintenance and use of testing and inspection;

3. Provision for frequency of sampling inspections;

4. Provision of necessary authority to reject defective work and carry out compliance assurance functions, notwithstanding any conflict with production department goals and needs;

5. A schematic of the manufacturing operation showing the location of inspection stations, and "hold" points for mandatory inspection characteristics;

6. Inspection and test procedures, including accept/reject criteria and mandatory inspection characteristics;

7. Standards of workmanship; and
8. Provision of disposal of rejects.

110.R3.10.4 Finished Product Control.

1. Procedure for final inspection of all manufactured buildings or manufactured building components before shipment to the site or storage point, including identification and labeling handling;
2. Procedures for handling and storing all finished manufactured buildings or manufactured building components, both at the manufacturing plant or other storage point and after delivery to the building site;
3. Procedures for packing, packaging and shipping operations and related inspections; and
4. Procedures for transportation, including all measures to protect against damage while in transit, and setting forth the modes of transportation to be utilized and the carrying equipment and procedures.

110.R3.10.5 Installation Control.

1. Installation procedures including component placement, equipment and procedures, field erection and finishing work, utility connection instructions and all appropriate on-site inspection criteria and test descriptions; and
2. Organizational provisions for field repair and disposal of rejects.

110.R3.10.6 Permission for Inspection. The manufacturer shall provide the BBRS with written permission, signed and notarized, for the State Enforcement Agencies to inspect his manufacturing facilities, his products, and building sites under his control at any reasonable time without prior announcement.

110.R3.10.7 Inspections by the State Enforcement Agencies. The Compliance Assurance Manual shall contain detailed plans for inspections by the State Enforcement Agencies or inspection agency.

PART III—APPROVAL OF INSPECTION AGENCIES

780 CMR 110.R3.11 REQUIREMENTS FOR SUBMISSION

An inspection agency seeking approval shall submit a quadruplicate application to the BBRS which shall include the items listed in 780 CMR 110.R3.1 1.

110.R3.11.1 Articles of Incorporation. The original Articles of Incorporation of the agency and all subsequent amendments thereto, as filed in the State of Incorporation.

110.R3.11.2 Bylaws. The bylaws of the organization, if any.

110.R3.11.3 Business Affiliations of Members. The names, addresses and business affiliations of all

members of the Board of Directors and of top management personnel.

110.R3.11.4 Stock. Individual interests representing more than 10% of the outstanding ownership reflecting the financial interest of the agency's Board of Directors and top management personnel.

110.R3.11.5 Certifications. Certification by the agency that.

1. Its Board of Directors, as a body, and its technical personnel, as individuals, can exercise independence of judgment; and
2. Its activities pursuant hereto will result in no financial benefit to the agency via stock ownership, or other financial interests in any producer, supplier or vendor of products involved, other than through standard published fees for services rendered.

110.R3.11.6 Experience of Directors. Names, years of experience, state in which professionally registered and other qualifications of the directors of inspection or evaluation programs.

110.R3.11.7 Experience of Employees. Names and years of experience of employees practicing in the following disciplines. architecture, structural engineering, mechanical engineering, electrical engineering, fire protection and other branches of engineering; the state in which each is registered and the service each performs.

110.R3.11.8 Organization Chart. An organization chart showing management and supervisory persons including the number of graduate engineers and architects, and the names of all consulting engineers or architects, designating which are full-time and which are part-time employees.

110.R3.11.9 Number and Location of Personnel. Number and location of factory inspectors, supervisors, and other technicians, including evaluators of factory inspectors and the qualifications of each specialized group, including records of work experience, licenses held and other pertinent qualifications; description of types of work each group and each technician is expected to perform and the qualifications of each group and each technician to perform the work assigned.

110.R3.11.10 Employees Training Programs. An outline of the training program, if any, of the agency to assure that all inspectors, evaluators and other technicians are properly trained to do each job assigned to them.

110.R3.11.11 Employee Supervision. An outline of the general procedures for supervision of inspectors and evaluators, including checking and evaluation of their work.

110.R3.11.12 Non-employees Relationships. All engineers, technicians and other personnel who will perform services for the organization but who are

not employees of the organization, and the supervisory and other relationships which each will have to the agency.

110.R3.11.13 Products Evaluated. Type of products, components, equipment, structures and other items which the organization has evaluated, tested or inspected and the number of years of experience the organization has had with each, and the type of codes, standards, specifications and requirements with respect to which the organization has had experience in providing evaluation, inspection or testing services, and the number of years experience with each.

110.R3.11.14 Frequency Capability. Description of the frequency with which the agency is capable of performing inspections or evaluations.

110.R3.11.15 State approved in. List of the states in which the agency is now approved to inspect or evaluate manufactured buildings or manufactured building components or parts thereof for compliance with approved building systems.

780 CMR 110.R3.12 PROCEDURES FOR APPROVING INSPECTION AGENCIES

110.R3.12.1 Qualifications. Upon the recommendation of the State Enforcement Agencies, the BBRS may approve inspection agencies which meet the requirements of the applicable codes and 780 CMR 110.R3.0 and which the State Administrative Agencies find otherwise qualified to perform the functions proposed to be delegated to them.

110.R3.12.2 Suitability of Application. Prior to a full evaluation of an application for approval, the BBRS shall determine whether such application is unsuitable for processing. In the event the application is found to be suitable for processing, the applicant shall be notified in writing of such unsuitability and the basis thereof within 30 days of the date of the application is received by the BBRS. In such event, all but \$25.00 of the fee will be returned, and the rulings of unsuitability shall be without prejudice. Any subsequent submission shall be treated as a new application.

110.R3.12.3 Approvals. In the event of approval of the BBRS, an inspection agency shall be notified by a letter from the BBRS indicating such approval and stating specifically the functions which the applicant has been approved to perform. Such approval shall not constitute the actual delegation of such functions.

780 CMR 110.R3.13 SUSPENSION AND REVOCATION

110.R3.13.1 Grounds. The BBRS may suspend or revoke its approval of any inspection agency if the approval was issued in error; was issued on the basis of incorrect information; was issued in violation of

any of the applicable Codes or 780 CMR 110.R3; if the inspection agency violates any of the applicable Codes or 780 CMR 110.R3, if examination discloses that the agency failed to perform properly; or for such other cause as may be deemed sufficient by the State Enforcement Agencies to warrant such action.

110.R3.13.2 Procedures.

110.R3.13.2.1 General. If the BBRS suspends or revokes the approval of an inspection agency, the inspection agency shall be given notice in writing from the BBRS of the suspension or revocation with the reasons therefore set forth therein. Manufacturers being evaluated or inspected by such agencies, all local enforcement agencies within this State, and the State Enforcement Agencies shall also be notified in writing of such suspension or revocation. Such notices shall contain instructions to the manufacturer and to the local enforcement agency as to the procedures to be followed regarding manufactured buildings or manufactured building components previously certified by an agency whose approval has been suspended or revoked.

110.R3.13.2.2 Records. An inspection agency whose approval has been suspended or revoked shall within 90 days of the suspension or revocation deliver to the custody of the BBRS the originals of all records required to be maintained during the course of the inspection agency's operations pursuant to the applicable codes and 780 CMR 110.R3.0.

110.R3.13.2.3 Labels. An inspection agency for which approval has been suspended or revoked shall within 90 days of the suspension or revocation deliver to the custody of the BBRS all labels in the agency's possession, under its control, or for which it is responsible pursuant to the applicable codes and 780 CMR 110.3.0.

PART IV—APPEALS

780 CMR 110.R3.14 HEARINGS

All hearings shall comply with applicable sections of the applicable codes and the Rules and Regulations thereof established for the purpose of appeal.

PART V—SCHEDULE OF FEES

780 CMR 110.R3.15 ESTABLISHMENT

The following is the SCHEDULE OF FEES established by the BBRS for certifying manufactured buildings or manufactured building components. Fees shall be made payable to the "Commonwealth of Massachusetts Board of Building Regulations and Standards" and shall accompany all applications for certification.

110.R3.15.1 Compliance Assurance Programs and Building Systems. An initial fee of \$1,200.00

shall be charged each manufacturer for its certified compliance assurance program for each plant desiring certification. The maximum fee charged under 780 CMR 110.R3. 15 shall be \$1,200.00 for each manufacturing plant.

110.R3.15.2 Third Party Inspection Agencies. An initial fee of \$500.00 shall be charged to each third party inspection agency.

110.R3.15.3 Annual Renewal Fees.

1. One year from the date of certification of the manufacturer and every year thereafter certification is in effect, there shall be paid an annual renewal fee of \$650.00 for each such certification.
2. One year from the date of certification of the Third Party Inspection Agency, and every year thereafter certification is in effect, there shall be paid an annual renewal fee of \$500.00.

110.R3.15.4 Labels.

1. A fee of \$50.00 per unit of a manufactured building shall be charged for each label issued by the BBRS.

Note: A "unit" as used in 780 CMR 110.R3.15 shall mean any building or proportion thereof which is towed or shipped separately to be tied together at the site.

2. A fee of \$10.00 per building component shall be charged for each label issued by the BBRS for building components.
3. Lost or damaged Labels Upon satisfactory proof to the BBRS of lost or stolen labels, not the result of negligence, labels may be replaced at a cost of \$2.00 each.

110.R3.15.5 Other Fees. The BBRS reserves the right to charge other fees based on scope of services necessary to be performed.

NON-TEXT PAGE

780 CMR 110.R4

LICENSING NATIVE LUMBER PRODUCERS

(Note: 780 CMR 110.R4 is unique to Massachusetts)

780 CMR 110.R4.1 ADMINISTRATION

110.R4.1.1 Scope. The provisions of 780 CMR 110.R4 shall govern the licensing of native lumber producers.

110.R4.1.2 Definitions. The following words and terms shall, for the purposes of 780 CMR 110.R4 and as used elsewhere in 780 CMR, have the meaning indicated in 780 CMR 110.R4.1.2.

BBRS. State Board of Building Regulations and Standards.

NATIVE LUMBER. Native lumber is wood processed in the Commonwealth of Massachusetts by a mill registered in accordance with the regulations of the BBRS. Such wood is ungraded but is stamped or certified in accordance with the requirements of the *Sixth Edition of the Massachusetts State Building Code*, 780 CMR 2303.1.1. For the purpose this definition, native lumber shall be restricted to use in one-and two-story dwellings, barns, sheds, agricultural and accessory buildings and structures and other uses as permitted by 780 CMR 23.00.

NATIVE LUMBER PRODUCERS. Persons or corporations in the business of milling wood into native lumber within the Commonwealth of Massachusetts.

PERSON. Individual, partnership, corporation, trust, joint venture, etc.

110.R4.1.3 Registration. No person shall engage in the producing of native lumber for use in buildings or structures within the Commonwealth of Massachusetts unless registered by the BBRS.

110.R4.1.4 Application for Registration. Each person desiring registration as producer of native lumber shall apply and furnish evidence satisfactory to the BBRS that he is qualified to be registered in accordance with 780 CMR 110.R4. Qualification requirements shall be provided by the BBRS with the application form.

110.R4.1.5 Registration Fee. Applications shall be accompanied by a registration fee of \$50.00. This initial registration shall be valid for two years.

110.R4.1.6 Renewals. Registration shall be renewed every two years. Within 30 days before the expiration date of any such registration, the BBRS shall forward to each person an application form for renewal. Upon receipt of the completed form and fee, BBRS shall renew the registration for a period of two years or notify the applicant of reasons for refusal. *Any application for renewal of registration which has expired shall require the payment of a new registration fee.*

110.R4.1.7 Prequalifying Agent. State Inspectors of the Department of Public Safety shall act as agents of the BBRS to inspect native lumber producing facilities. Upon receipt of a completed application, the State Inspector shall inspect the facility for compliance with the required qualifications and make recommendation to the BBRS.

110.R4.1.8 Penalties. Any person who fails to comply with the requirements of 780 CMR 110.R4 or who falsifies an application shall be subject to the penalties and actions as prescribed in 780 CMR 118.0.

780 CMR 110.R4.2 REGISTRATION STAMP

110.R4.2.1 Stamp. Each person registered by the BBRS shall be issued a specific name and number for use in stamping or certifying the native lumber which he produces.

110.R4.2.2 Stamp Contents. Each stamp shall be a minimum of two inches by four inches with a minimum of 36 pt. letters and shall contain the following information.

1. Name of native lumber producer;
2. Registration number; and
3. Species of wood.

110.R4.2.3 Stamp Use. Each piece of native lumber produced shall bear the producer's stamp.

110.R4.2.4 Stamp - Unlawful Use. It shall be unlawful to use a stamp registered for a specific mill at any other mill.

110.R4.2.5 Stamp - Manufacture. Each producer shall be responsible for obtaining stamps made for their use in accordance with the requirements of the BBRS and 780 CMR 110.R4.

780 CMR 110.R4.3 REVOCATION AND SUSPENSION PROCEDURES

110.R4.3.1 Revocation and Suspension. The BBRS on its own initiative or upon the recommendation of the State Inspector may suspend or revoke the registration of any such mill registered in accordance with 780 CMR 110.R4, 780 CMR or the standards of good practice. Notice of suspension or revocation of such registration shall be in writing with the reasons for suspension or revocation clearly set forth, and served in accordance with 780 CMR 118.6.

110.R4.3.2 Notice and Conference. Prior to suspension or revocation of the registration of any such mill so registered, written notice of such intent shall be served by the State Inspector in accordance

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with 780 CMR 118.6. Within ten calendar days of receipt of such notice, the affected mill may request a conference with the State Inspector who will hear facts and make their recommendations to the BBRS.

110.R4.3.3 Effect of. Upon suspension or revocation of the registration of any such mill so registered, such mill shall immediately cease engaging in the stamping or certifying of native lumber. The filing of an appeal with the State Building Code Appeals Board shall stay such

suspension or revocation subject to 780 CMR 122.3.2.

780 CMR 110.R4.4 APPEALS

110.R4.4.1 Building Code Appeals Board.

Anyone aggrieved by the decision of the BBRS, or others may appeal to the State Building Code Appeals Board in accordance with 780 CMR 122.0.

780 CMR 110.R5

CONSTRUCTION SUPERVISORS

(Note: This Regulation is unique to Massachusetts)

780 CMR 110.R5 covers the licensing rules and regulations for construction supervisors as defined in 780 CMR. 780 CMR 110.R5 shall become in full force and effect on January 1, 2007.

780 CMR 110.R5.1 GENERAL

110.R5.1.1 Authority. As authorized by M.G.L. c. 143, § 94(g) and (i), the BBRS establishes the rules and regulations for Licensing Construction Supervisors.

110.R5.1.2 Definitions. Unless otherwise expressly stated in 780 CMR the following terms shall, for the purpose of 780 CMR 110.R5, have the meaning indicated in 780 CMR 110.R5.1.2.

BBRS. State Board of Building Regulations and Standards.

CONSTRUCTION SUPERVISOR. A person of good moral character who is deemed qualified by the BBRS and has acquired a license by methods herein prescribed in one or more of the following categories:

CATEGORIES OF LICENSE.

1. Unrestricted Construction Supervisor License (UCSL). An Unrestricted Construction Supervisor License allows an individual to directly supervise persons engaged in the construction, reconstruction, alteration, repair, removal or demolition involving any activity regulated by 780 CMR in respect to the following types of buildings and structures. (Such term shall also apply to persons supervising themselves.)

- (a) Buildings of any use group as defined by 780 CMR 51.00 through 99.00 which contain less than 35,000 cubic feet (991 m³) of enclosed space;
- (b) One- and two-family dwelling buildings or any accessory building thereto, irrespective of size;
- (c) Buildings used for farm purposes;
- (d) Retaining walls less than ten feet (3048 mm) in height at all points along the wall as measured from the base of the footing to the top of the wall.

2. Restricted Construction Supervisor License (RCSL). An Restricted Construction Supervisor License allows an individual to directly supervise persons engaged in the construction, reconstruction, alteration, repair, removal or demolition involving any activity regulated by 780 CMR in respect to one- and two-family dwelling buildings and any accessory building thereto, irrespective of size. (Such term shall also apply to persons

supervising themselves.)

A licensed construction supervisor possessing at least a restricted category license shall be required for the installation of all manufactured one and two family homes as required by 780 CMR 51.00 through 99.00 and 780 CMR 110.R3, as applicable.

3. Masonry Only Construction Supervisor License (MCSL). A Masonry Only Construction Supervisor License allows an individual to directly supervise persons engaged in the construction, reconstruction, alteration, repair, removal or demolition involving the elements of fireplaces, chimneys, required means of egress stairs made of masonry, masonry retaining walls deemed to be a threat to public safety, health or welfare and that retain four feet or more of unbalanced fill, and other masonry structures for which a building permit is required, so long as such is not governed by construction control provisions of the Massachusetts Basic Building Code. Such term shall also apply to persons supervising themselves. (A masonry only license is not sufficient for the construction of masonry buildings. Supervision of such work would require possession of at least a restricted license, dependent upon the scope of work.)

4. Residential Roof Covering Construction Supervisor License (RCCSL). A Residential Roof Covering Construction Supervisor License allows an individual to directly supervise persons engaged in the installation, alteration, repair or removal of residential roof coverings as defined by 780 CMR 51.00 through 99.00. Such term shall also apply to persons supervising themselves. (A Residential Roof Covering License does not allow the licensee to work on or supervisor work relating to the structural elements of a residential roof, including sheathing. Such work would require possession of at least a restricted license, dependent upon the scope of work.)

5. Residential Window and Siding (Exterior Weather Protection) Construction Supervisor License (WSCSL). A Residential Window and Siding (Exterior Weather Protection) Construction Supervisor License allows an individual to directly supervise persons engaged in the installation, alteration, repair or removal of residential windows and siding as defined by this code. Such term shall also apply to persons supervising themselves. (A Residential Window and Siding License does not allow the licensee to work on or supervisor work relating to the structural

elements of a residential building, including sheathing. Such work would require possession of at least a restricted license, dependent upon the scope of work.)

6. **Residential Solid Fuel-Burning Appliance Installer Construction Supervisor License (SFCSL).** A Residential Solid Fuel-Burning Appliance Installers License allows an individual to directly supervise persons engaged in the installation, alteration, repair or removal of residential solid fuel-burning appliances by 780 CMR 51.00 through 99.00. Such term shall also apply to persons supervising themselves. (A Residential Solid Fuel-burning Appliance Installer Construction Supervisor License does not allow the licensee to work on or supervisor work relating to any structural elements of a residential building, including sheathing. Such work would require possession of at least a restricted license, dependent upon the scope of work.)

7. **Demolition Only Construction Supervisor License (DCSL).** A Demolition Only Construction Supervisor License allows an individual to directly supervise persons engaged in the demolition or removal of single- and two-family residential building and accessory structures. Such term shall also apply to persons supervising themselves. (A Demolition Only Construction Supervisor License does not allow the licensee to work on or supervisor construction, reconstruction alteration or repair work relating to residential buildings. Such work would require possession of at least a restricted license, dependent upon the scope of work.)

HEARINGS OFFICER. The Hearings Officer is the person selected by the BBRS to carry out the disposition of complaints against licensed construction supervisors or other individuals or entities licensed, registered or certified under the provisions of 780 CMR.

LICENSED DESIGNEE. Any individual designated by the license holder to be present, in the absence of said license holder, during any of the periods stated in 780 CMR 110.R5.2.12. Such designee shall also hold a Construction Supervisor's License in the appropriate category (or better), but his name or license number need not be contained on the building permit application.

RECOGNITION. The approval by the BBRS of an application and related documents by one desirous of being licensed as a construction supervisor.

110.R5.1.3 Scope.

1. 780 CMR 110.R5 shall govern the testing and licensing of individuals who are found to possess the requisite qualifications to be licensed as a

construction supervisor and to have charge or control of construction, reconstruction, alteration, repair, removal or demolition of certain buildings or structures or parts thereof, as identified.

2. Except for those structures governed by Construction Control as regulated by the *Seventh Edition of the Massachusetts State Building Code*, 780 CMR 116.0 (the *Massachusetts Basic Building Code* for buildings other than one- and two-family dwellings), any individual directly supervising persons engaged in construction, reconstruction, alteration, repair, removal or demolition involving activities regulated by 780 CMR shall be licensed in an appropriate category according to 780 CMR 110.R5.2.

110.R5.1.4 Administration and Enforcement. The BBRS shall administer and enforce the provisions of 780 CMR 110.R5. The BBRS or those designated by it shall administer examinations, under 780 CMR 110.R5, of persons desirous of being registered as qualified to receive a license as a construction supervisor.

110.R5.1.5 Hearings Officer. The BBRS shall appoint a Hearings Officer or Hearings Officers and who shall serve at the pleasure of the Board. Hearings Officer(s) shall conduct hearings on behalf of the Board relative to complaints filed against CSL holders and shall issue corresponding decisions.

780 CMR 110.R5.2 REGISTRATION AND LICENSING

110.R5.2.1 Qualifications. Each applicant for license must prove to the Board that he or she possesses at least the minimum qualifications identified below for the category of license sought. Members of the Board of Building Regulations and Standards (BBRS) may consider other acceptable evidence if an applicant, for reasons beyond his or her control, is not able to provide letters of attestation as described.

1. **Unrestricted Construction Supervisor License (UCSL).** An Unrestricted Construction Supervisor License candidate shall demonstrate that he or she has had at least three years of experience in building construction or design under the supervision of an individual possessing an unrestricted construction supervisors license or a registered professional engineer or architect. Acceptable evidence in demonstration of this requirement shall be in the form of a letter of attestation by the licensed construction supervisor or registered professional engineer or architect indicating that the candidate possesses such minimum qualification and identifying specific projects (spanning a period of at least three years) in which the candidate was involved. Said letter shall be made part of the application to examine as described in 780 CMR 110.R5.2.6.

Successful completion of a three or four year vocational high school or other vocational school program in the field of building construction shall be deemed as satisfying one year of the required three years experience as cited 780 CMR 110.R5.2.1. (The BBRS shall determine when vocational training other than in building construction, satisfies a portion of the three year experience criteria.)

2. Restricted Construction Supervisor License (RCSL).

A Restricted Construction Supervisor License candidate shall demonstrate that he or she has had at least three years of experience in the construction or design of single- or two-family dwelling buildings under the supervision of an individual possessing an restricted construction supervisors license, a registered professional engineer or architect or a home designer. Acceptable evidence in demonstration of this requirement shall be in the form of a letter of attestation by the licensed construction supervisor, registered professional engineer or architect or home designer indicating that the candidate possesses such minimum qualification and identifying specific projects (spanning a period of at least three years) in which the candidate was involved. Said letter shall be made part of the application to examine as described in 780 CMR 110.R5.2.6.

Successful completion of a three or four year vocational high school or other vocational school program in the field of building construction shall be deemed as satisfying one year of the required three years experience as cited 780 CMR 110.R5.2.1. (The BBRS shall determine when vocational training other than in building construction, satisfies a portion of the three year experience criteria.)

3. Residential Roof Covering Construction Supervisor License (RCCSL). A Residential Roof Covering Construction Supervisor License candidate shall demonstrate that he or she has had at least three years of experience in the installation, alteration, repair or removal of residential roof coverings as defined by 780 CMR 51.00 through 99.00. Acceptable evidence in demonstration of this requirement shall be as identified on the application to examine as described in 780 CMR 110.R5.2.6.

Candidates for this license who can demonstrate to the satisfaction of the Board that they have had at least five years experience in the supervision of individuals engaged in the installation, alteration, repair or removal of residential roof coverings as defined by this code shall receive a license in this category without being required to examine. Said experience shall be within the period spanning January 1990 to January 2008. Acceptable evidence in demonstration of this requirement shall be in the

form of a letter of attestation by the candidate indicating that he or she possesses such minimum qualification and identifying specific projects (spanning a period of at least a five years during the noted time frame) in which the candidate was involved with residential roof projects, noting the name of the owner and address of said projects. Said letter shall be made part of the application to examine as described in 780 CMR 110.R5.2.6.

The Board shall establish a date—certain when this license is required.

4. Residential Window and Siding (Weather Protection) Construction Supervisor License (WSCSL). A Residential Window and Siding Construction Supervisor License candidate shall demonstrate that he or she has had at least three years of experience in the installation, alteration, repair or removal of residential windows and/or siding as defined by 780 CMR 51.00 through 99.00. Acceptable evidence in demonstration of this requirement shall be as identified on the application to examine as described in 780 CMR 110.R5.2.6.

Candidates for this license who can demonstrate to the satisfaction of the Board that they have had at least five years experience in the supervision of individuals engaged in the installation, alteration, repair, or removal of residential widows and/or siding as defined by this code shall receive a license in this category without being required to examine. Said experience shall be within the period spanning January 1990 to January 2008. Acceptable evidence in demonstration of this requirement shall be in the form of a letter of attestation by the candidate indicating that he or she possesses such minimum qualification and identifying specific projects (spanning a period of at least a five years during the noted time frame) in which the candidate was involved with residential window and siding projects, noting the name of the owner and address of said projects. Said letter shall be made part of the application to examine as described in 780 CMR 110.R5.2.6.

5. Residential Solid Fuel-Burning Appliance Installer Construction Supervisor License (SFCSL). A Residential Solid Fuel-Burning Appliance Installer Construction Supervisor License candidate shall demonstrate that he or she has had at least three years of experience in the installation, alteration, repair or removal of residential solid fuel-burning appliances as defined by 780 CMR 51.00 through 99.00. Acceptable evidence in demonstration of this requirement shall be as identified on the application to examine as described in 780 CMR 110.R5.2.6 together with any technical knowledge the Board may require him or her to possess.

Candidates for this license who can demonstrate to the satisfaction of the Board that they have had at least five years experience in the supervision of individuals engaged in the installation, alteration, repair or removal of residential solid fuel-burning appliances as defined by this code shall receive a license in this category without being required to examine. Said experience shall be within the period spanning January 1990 to January 2008. Acceptable evidence in demonstration of this requirement shall be in the form of a letter of attestation by the candidate indicating that he or she possesses such minimum qualification and identifying specific projects (spanning a period of at least five years during the noted time frame) in which the candidate was involved in residential solid fuel-burning projects, noting the name of the owner and address of said projects. Said letter shall be made part of the application to examine as described in 780 CMR 110.R5.2.6.

The Board shall establish a date—certain when this license is required.

6. Demolition Only Construction Supervisor License (DCSL). A Demolition Only Construction Supervisor License candidate shall demonstrate that he or she has had at least three years of experience in the demolition or removal of single- and two-family dwelling buildings and accessory structures as defined by this code. Acceptable evidence in demonstration of this requirement shall be as identified on the application to examine as described in 780 CMR 110.R5.2.6.

Candidates for this license who can demonstrate to the satisfaction of the Board that they have had at least five years experience in the supervision of individuals engaged in the demolition or removal of single- and two-family dwelling buildings and accessory structures as defined by 780 CMR 51.00 through 99.00 shall receive a license in this category without being required to examine. Said experience shall be within the period spanning January 1990 to January 2008. Acceptable evidence in demonstration of this requirement shall be in the form of a letter of attestation by the candidate indicating that he or she possesses such minimum qualification and identifying specific projects (spanning a period of at least five years during the noted time frame) in which the candidate was involved with the demolition or removal of single- and two-family dwelling buildings and accessory structures, noting the name of the owner and address of said projects. Said letter shall be made part of the application to examine as described in 780 CMR 110.R5.2.6.

The Board shall establish a date—certain when this license is required.

7. Masonry Only Construction Supervisor License (MCSL) A Masonry Only Construction

Supervisor License candidate shall demonstrate that he/she has had at least three years of experience in the construction, reconstruction, alteration, repair, removal or demolition involving the elements of fireplaces, chimneys, required means of egress stairs made of masonry, masonry retaining walls deemed to be a threat to public safety, health or welfare and that retain four feet or more of unbalanced fill, and other masonry structures for which a building permit is required. Acceptable evidence in demonstration of this requirement shall be as identified on the application to examine as described in 780 CMR 110.R5.2.6.

Candidates for this license who can demonstrate to the satisfaction of the Board that they have had at least five years experience in the supervision of individuals engaged in the construction, reconstruction, alteration, repair, removal or demolition involving the elements of fireplaces, chimneys, required means of egress stairs made of masonry, masonry retaining walls deemed to be a threat to public safety, health or welfare and that retain four feet or more of unbalanced fill, and other masonry structures for which a building permit is required as defined by this code shall receive a license in this category without being required to examine. Said experience shall be within the period spanning January 1990 to January 2008. Acceptable evidence in demonstration of this requirement shall be in the form of a letter of attestation by the candidate indicating that he/she possesses such minimum qualification and identifying specific projects (spanning a period of at least five years during the noted time frame) in which the candidate was involved with masonry projects, noting the name of the owner and address of said projects. Said letter shall be made part of the application to examine as described in Section 110.R5.2.6.

110.R5.2.2 Examinations. Examinations shall be held only by appointment. All applications must be filed in accordance with the Massachusetts Construction Supervisor (MACS) Candidate Bulletin of Information.

110.R5.2.3 License Approval. A majority vote of the members of the Board shall be required to grant a license.

110.R5.2.4 Expiration. Licenses issued pursuant to these rules and regulations shall expire three years from the date of issuance which shall be noted on said license and may be renewed.

A renewal of an original license shall be for periods of two years and a renewal license shall expire two years from the date of issuance which shall be noted on said license and may be renewed..

A renewal license shall not be issued unless application therefore is made within one year of the date of expiration of the most recently issued license. Failure to submit a renewal application and to acquire a license within this time period shall be cause for examination or reexamination.

110.R5.2.5 Fees. See 780 CMR 110.R5.3.5.

110.R5.2.5.1 Building Official Fees. The BBRS shall grant a license at no fee to any building official who, as a condition of his employment requires such license; provided that such person meets the necessary qualifications for licensure and provided further, that such license shall be authorized for use only during the course of employment and shall be appropriately stamped to indicate as such.

110.R5.2.6 Procedure for Obtaining a License.

110.R5.2.6.1 Application. Applications shall be submitted on forms supplied by the BBRS or its authorized agent.

110.R5.2.6.2 Forms. The applicable forms may be mailed to the appropriate testing agency as detailed in the Massachusetts Candidates Bulletin (MACS). It shall be the responsibility of the applicant to assure that the required forms are received by the testing agency. All forms shall be accompanied by the required license fee.

110.R5.2.6.3 Records. The BBRS shall keep a copy of the application and a computer file listing all licensed construction supervisors.

110.R5.2.6.4 Notification of Examination Date. Upon receipt of a fully completed application, an examination date shall be set and the applicant so notified.

110.R5.2.7 False Statements. Any false statement on the application or references shall be sufficient reason to refuse to issue a license, or to suspend or revoke a license if issued.

110.R5.2.8 Cause for Reprimand, Suspension or Revocation. The following shall be grounds for reprimand, suspension or revocation of a license:

- (1) the applicant made a false statement on their application for licensure;
- (2) a licensee made a false statement to the Board;
- (3) any violation of 780 CMR;
- (4) work was performed without a building permit in violation of 780 CMR 11.0 and 5111.0;
- (5) failure to fully cooperate with a Board investigation into a complaint;
- (6) failure to turn over a suspended or revoked license to the Board
- (7) failure to abide by a mandate or order of the Board
- (8) failure to properly supervise a project or be present at a work site as required by 780 CMR 110.R5.2.15.2.

110.R5.2.9 Procedure for Suspension and/or Revocation of License.

110.R5.2.9.1 Complaints. All complaints relative to a licensee must be in writing on a form provided by the Board. Any person, including a building official or the Board itself, may file a complaint. A complaint may allege wrongdoing against an HIC registration and a CSL holder on the same form if the issues giving rise to the filing of the complaint are reasonably related. All complaints must be received by the Board within three years of the date the parties entered into an agreement to perform the work requiring licensure pursuant to these provisions.

110.R5.2.9.1.1 Basis of Complaint. Work related to a specific building permit that is deemed to be in violation of *The Massachusetts Basic and/or One and Two-Family Dwelling Code*, 780 CMR 110R5 or the Home Improvement Contractor Registration Laws and/or regulations, or a consistent pattern of abuse relating to contractual arrangements between license holder and client shall be the basis of such complaint. Any work requiring a building permit which is performed without such permit shall be considered cause for suspension or revocation.

110.R5.2.9.2 Review and Investigation of Complaints. Every complaint filed shall be reviewed by the Board or its designee. If the reviewer determines that the complaint alleges plausible potential violations of 780 CMR by the licensee, a hearing shall be convened. The Board may, if it elects, investigate a complaint prior to scheduling a hearing. Failure of a complainant to cooperate in the investigation shall be grounds for dismissal of a complaint.

If a complaint alleges violations of the Home Improvement Contractor Act (M.G.L. c. 142A: *Regulation of Home Improvement Contractors*) and/or 780 CMR 110.R6 in addition to allegations pursuant to the provisions of 780 CMR 110.R5, one hearing may be held on all issues alleged provided that they all arise out of the same set of facts and circumstances.

Upon receipt of a complaint, the Board or its designee shall send a letter acknowledging receipt to the complainant, the licensee being complained of, and the appropriate municipal building official. A copy of the complaint and all attachments shall be mailed to the license holder with the acknowledgment letter

110.R5.2.9.3 Notice of Hearing. If the Hearings Officer or the Board determines that a hearing shall be held to resolve a complaint, reasonable notice shall be provided to the complainant and the license holder. Mailing of notice to the address on record with the BBRS shall be deemed satisfactory notice to the license holder. The

notice of hearing shall contain.

1. The name of the complainant.
2. The date, time and place of said hearing.
3. The location of the incident giving rise to the complaint.
4. Notice that either party may view the Board's complaint file by appointment.

110.R5.2.9.4 Hearing. Hearings convened pursuant to this chapter shall be conducted pursuant to 801 CMR 1.02 (Informal/fair hearing rules). Any party may be represented by legal counsel. All parties shall be permitted to present an opening statement, testify on their own behalf, cross-examine all witnesses, present any relevant witness testimony, present any relevant documentary evidence, and offer a closing argument. The Hearing Officer may question any witness and include any records kept by the Board as exhibits. The Hearing Officer may conclude the hearing at any time and issue a decision based on the evidence presented.

If a licensee does not appear for the hearing, the Hearing Officer may conduct a hearing in their absence and render a decision based upon the evidence presented, but only after making a finding that the licensee was provided notice as required by 780 CMR 110.R5.2.9.3.

110.R5.2.9.5 Decisions and Discipline of License Holders. The hearings officer shall issue a written decision after the hearing. Decisions shall be issued in a reasonably prompt manner. The hearing officer may suspend a license for a fixed period of time, revoke a license permanently, or reprimand the licensee. In conjunction with these disciplinary measures, the hearing officer may order the license holder to retake the CSL examination. Any license that is suspended or revoked shall be forwarded to the Board immediately. A person whose license is revoked may apply in writing to the Board for reinstatement no sooner than two years from the date of the revocation.

110.R5.2.10 Appeal. Any person aggrieved by a decision of the hearings officer may, in writing, request review of said decision by the BBRS. The filing of such a petition shall not serve to stay any disciplinary action taken by the Hearings Officer. The BBRS may review such decision at its discretion. Such review is an administrative review that shall be based solely on the administrative record and is not to be construed as a second Hearing on the same complaint(s). After review, the Board may either deny the petition or remand the matter to the Hearings Officer for further proceedings as directed. The filing of an appeal with the Board shall serve to toll the timing provisions of M.G.L. c. 30A, § 14 until such time as a final decision is rendered by the Board.

110.R5.2.10.1 Appeal to a Court. Any person aggrieved by a decision of the Hearings Officer or the Board may appeal such decision in conformance with M.G.L. c. 30A, § 14.

110.R5.2.11 Change of Address. The license holder shall have the responsibility of reporting any change of address and/or change of circumstance to the BBRS. The information on file at the BBRS shall be deemed accurate unless changed by the license holder.

110.R5.2.12 On-site Presence of Supervisor. An Unrestricted or Restricted licensed holder or a licensed designee as defined shall be present on the site at some point to approve construction, reconstruction, alterations, removal or demolition involving the following work.

Note: Any Licensed Construction Supervisor who contracts to do work for a homeowner shall be responsible for performing said work in accordance with 780 CMR 51.00 through 99.00, 780 CMR 110.R5 and all reference standards and/or manufacture's recommendations, whether or not the licensed contractor secured the permit for said work:

1. Foundation.
 - a. Preparation of bearing material;
 - b. Location of foundation;
 - c. Placement of forms and reinforcing materials (if applicable);
 - d. Placing of concrete (or setting of other foundation materials);
 - e. Setting weather protection methods (if required);
 - f. Installation of waterproofing and/or dampproofing materials; and
 - g. Placement of backfill.

Note: If encountered in excavating for foundation placement, the licensed construction supervisor shall report the presence of groundwater to the building official and shall submit a report detailing methods of remediation.

2. Structural frame.
 - a. Installation of joists, trusses and other structural members and sheathing materials to verify size, species and grade, spacing and attachment/fastening methods. (The licensed construction supervisor shall ensure that any cutting or notching of structural members is performed in accordance with requirements of 780 CMR 51.00 through 99.00.)
 - b. Setting of masonry or other structural systems (if used).
3. Energy conservation. Installation of insulation materials, vapor and air infiltration barriers.

4. Fire protection. Installation of smoke, heat and carbon monoxide (CO) detectors and/or systems.

5. Special construction, including, but not limited to:

- a. Chimneys;
- b. Retaining walls over four feet (1219 mm) in height above grade.

The building official may require an unrestricted or restricted license holder or his or her licensed designee to be present on the building site at other points during the construction, reconstruction, alterations, removal or demolition work as he or she deems appropriate.

Exception: Any homeowner performing work for which a building permit is required shall be exempt from the licensing provisions provided that if a homeowner engages a person(s) for hire to do such work, that such homeowner shall act as supervisor and shall be subject to all applicable provisions of 780 CMR 51.00 through 99.00 and 780 CMR 110.R5. This exception shall not apply to the field erection of manufactured buildings constructed pursuant to 780 CMR 51.00 through 99.00 and 780 CMR 110.R3. (See definition of "Homeowner" in 780 CMR 51.00.)

Note: Registered architects and/or professional engineers who secure building permits for and/or perform construction services for detached one- and two-family dwellings are not required to be licensed pursuant to 780 CMR 110.R5 provided that said registered architect or professional engineer secures such permit or performs such services under the responsibilities of his or her professional registration and supervises construction activities as prescribed by 780 CMR 110.R5.2.12.

Exception: An unrestricted or restricted licensed construction supervisor as defined shall be required for installation of manufactured one and two family homes as required by 780 CMR 110.R3.

Masonry Only Construction Supervisor License Holder (MCSL), Residential Roof Covering Construction Supervisor License Holder (RCCSL), Residential Window and Siding (Exterior Weather Protection) Construction Supervisor License Holder (WSCSL), or Residential Solid Fuel-Burning Appliance Installer Construction Supervisor License Holder (SFCSL) shall be present on the job site at such times as deemed necessary to ensure compliance with the *Massachusetts Basic and/or One- and Two-Family Dwelling Code* and 780 CMR 110.R5.

110.R5.2.13 Lost/Stolen Licenses. License holders are required to keep the license in their possession at all times during the course of construction work at

any and all building sites. If said license is lost, stolen or mutilated, it shall be the responsibility of the license holder to notify the BBRS.

110.R5.2.14 Requirement to Show License. Any building official may require the license holder to produce the license at any time on a job site.

110.R5.2.15 Responsibility of Each License Holder.

110.R5.2.15.1 Responsibility for Work. The license holder shall be fully and completely responsible for all work for which he/she is supervising. He/she shall be responsible for seeing that all work is done pursuant to 780 CMR and the drawings as approved by the Building Official.

110.R5.2.15.2 Responsibility to Supervise Work. The construction, reconstruction, alteration, repair, removal or demolition of all detached one- and two-family dwellings or the field erection of any manufactured building shall be under the control of a licensed construction supervisor.

At a minimum, the license holder, as identified on the building permit application, or his or her licensed designee, shall be present on the building site to approve construction, reconstruction, alterations, removal or demolition involving the following work:

1. Foundation:
 - (a) Location of and excavation of foundation;
 - (b) Preparation of bearing material;
 - (c) Placement of forms and reinforcing materials (if applicable);
 - (d) Incorporation of vapor retarders (energy conservation)
 - (e) Placing of concrete (or setting of other foundation materials);
 - (f) Setting weather protection methods (if required);
 - (g) Installation of waterproofing and/or damp proofing materials; and
 - (h) Placement of backfill.

Note: If encountered in excavating for foundation placement, the licensed construction supervisor (or registered design professional) shall report the presence of groundwater to the building official and shall submit a report detailing methods of remediation.

2. Structural frame:

- (a) Installation of joists, trusses and other structural members and sheathing materials to verify size, species and grade, spacing and attachment/fastening methods (the licensed construction supervisor shall ensure that any cutting or notching of structural members is performed in accordance with requirements of 780 CMR;

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- (b) Setting of masonry or other structural systems (if used).
- 3. Energy conservation: Installation of insulation materials, vapor and air infiltration barriers.
- 4. Fire protection: Installation of smoke and heat detectors and/or systems.
- 5. Special construction (including, but not limited to):
 - (a) Chimneys;
 - (b) Retaining walls over four feet (1219 mm) in height above grade.

The building official may require the license holder or his or her licensed designee (or registered design professional) to be present on the building site at other points during the construction, reconstruction, alterations, removal or demolition work as he or she deems appropriate.

When required by the building official, at the completion of the work, prior to the issuance of a certificate of occupancy, the licensed construction supervisor, registered professional or homeowner, as applicable, shall submit a copy of the completed checklist contained in Appendix 780 CMR 120.P to the building official in verification that, to the best of his or her knowledge, the work has been executed in accordance with the provisions of 780 CMR.

110.R5.2.15.3 Notification of Violations. The license holder shall immediately notify the building official in writing of the discovery of any violations which are covered by the building permit.

110.R5.2.16 Permit Applications. All building permit applications shall contain the name, signature and license number and the category of license so

held of the construction supervisor who is to supervise those persons engaged in construction, reconstruction, alteration, installation repair, removal or demolition as regulated by the *Sixth Edition of the Massachusetts State Building Code*, 780 CMR 108.3.5, 780 CMR 51.00 through 99.00 and 780 CMR 110.R5 in the event that such licensee is no longer supervising said persons, the work shall immediately cease until a successor license holder is substituted on the records of the building department.

110.R5.2.17 Gender of Terms. The term "he" as used in 780 CMR R5 shall include the pronoun "he" and/or "she."

780 CMR 110.R5.3 ADMINISTRATION

110.R5.3.1 Identification. The BBRS shall issue a card or a certificate or other form of identification.

110.R5.3.2 Records of Licensees. The BBRS shall maintain a computer listing which will be available to the public at the office of the BBRS containing all licenses issued by the BBRS.

110.R5.3.3 Examination. The Board shall determine whether an examination shall be required, or shall be oral or written and shall determine the content of the examination, if applicable.

110.R5.3.4 Subject to Rules, Regulations and Procedures. All persons licensed shall be subject to 780 CMR 110.R5, as well as other rules, regulations, and procedures promulgated by this BBRS.

110.R5.3.5 Fees. Any and all fees charged for license fees, examination fees, renewal fees, and registration fees shall be determined by the Commonwealth and enforced by the BBRS. Examination fees shall be established from time to time as necessary.

REGISTRATION AND ENFORCEMENT OF HOME IMPROVEMENT CONTRACTOR PROGRAM

(Note: This Regulation is unique to Massachusetts)

FORWARD

780 CMR 110.R6 covers the registration of home improvement contractors and subcontractors and enforcement of the requirements of M.G.L. c. 142A as they pertain to home improvement contractors and subcontractors. Other regulations applicable to the Home Improvement Contractor program include:

201 CMR 14.00. Operation of the home improvement arbitration program authorized by M.G.L. c. 142A, promulgated by the secretary of the Office of Consumer Affairs and Business Regulations.

201 CMR 15.00. Operation of the home improvement guaranty fund, promulgated by the secretary of the Office of Consumer Affairs and Business Regulations.

780 CMR 110.R6.1 General Provisions

- 110.R6.1.1 Authority
- 110.R6.1.2 Definitions
- 110.R6.1.3 Scope
- 110.R6.1.4 Administration and Enforcement
 - 110.R6.1.4.1 Director responsibility
 - 110.R6.1.4.2 Advisory board
- 110.R6.1.5 Persons Who Must Register
 - 110.R6.1.5.1 Filing of application
 - 110.R6.1.5.2 Designated individual
 - 110.R6.1.5.3 Liability
- 110.R6.1.6 Persons Exempt From Registration

780 CMR 110.R6.2 Registration Procedure

- 110.R6.2.1 Applicant Actions
 - 110.R6.2.1.1 Application
 - 110.R6.2.1.2 Supporting documentation
 - 110.R6.2.1.3 Mailing address
 - 110.R6.2.1.4 Certified check/money order
 - 110.R6.2.1.5 Lost/destroyed certificate
 - 110.R6.2.1.6 Licensee liability
- 110.R6.2.2 Director's Action on Application
 - 110.R6.2.2.1 Issuance of certificate
 - 110.R6.2.2.2 Grounds for refusal to register
 - 110.R6.2.2.3 Application refused
 - 110.R6.2.2.4 Record retention
- 110.R6.2.3 Duration of Registration
- 110.R6.2.4 Fees to be Paid Upon Registration or Renewal
 - 110.R6.2.4.1 Registration and renewal fee
 - 110.R6.2.4.2 Contribution to guaranty fund-initial registration
- 110.R6.2.5 Responsibilities of Each Registrant
 - 110.R6.2.5.1 Changes in status
 - 110.R6.2.5.2 Display of certificate number
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780 CMR 110.R6.3 Enforcement Procedure

- 110.R6.3.1 Notification of Violation
- 110.R6.3.2 Consideration of Factors
- 110.R6.3.3 Letter of Reprimand
- 110.R6.3.4 Suspension, Revocation, Administrative Penalties
 - 110.R6.3.4.1 Hearing procedure
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110.R6.3.6 Fines and Criminal Penalties

780 CMR 110.R6.4 Enforcement Actions

- 110.R6.4.1 Administrative Penalties
 - 110.R6.4.1.1 Allowable actions
 - 110.R6.4.1.2 Pendency of claims
- 110.R6.4.2 Fines and Criminal Penalties
 - 110.R6.4.2.1 Sought by attorney general or district attorney
 - 110.R6.4.2.2 Operating without certificate
 - 110.R6.4.2.3 Other violations
- 110.R6.4.3 Injunction, Restitution
 - 110.R6.4.3.1 Order from superior court
 - 110.R6.4.3.2 Director bond not required
- 110.R6.4.4 Permit Requirements, Prohibited Acts and Penalties
 - 110.R6.4.4.1 Permit requirements
 - 110.R6.4.4.2 Prohibited acts
 - 110.R6.4.4.3 Penalties
 - 110.R6.4.4.4 Deceptive act

780 CMR 110.R6.5 Contracts

- 110.R6.5.1 Contract in Writing
- 110.R6.5.2 Contents of Contract
 - 110.R6.5.2.1 Documents and information
 - 110.R6.5.2.2 Permit notice
 - 110.R6.5.2.3 Acceleration of payment
 - 110.R6.5.2.4 Copy to owner
 - 110.R6.5.2.5 Alternative dispute resolution
- 110.R6.5.3 Dispute Resolution
 - 110.R6.5.3.1 Court action
 - 110.R6.5.3.2 Owner right to arbitration
 - 110.R6.5.3.3 Contractor right to arbitration
- 110.R6.5.4 Validity of contract

780 CMR 110.R6.6 Supplementary Identification Cards

- 110.R6.6.1 Definitions
- 110.R6.6.2 Certificates of registrants
 - 110.R6.6.2.2 Non-Individual Registrants
- 110.R6.6.3 Fees
- 110.R6.6.4 Expiration

780 CMR 110.R6.1 GENERAL PROVISIONS

110.R6.1.1 Authority. 780 CMR 110.R6 is authorized and promulgated by the administrator of the State Board of Building Regulations and Standards under the authority of M.G.L. c. 142A, § 16 and M.G.L. c. 143, § 94(g).

110.R6.1.2 Definitions.

APPLICATION. The form provided by the director which, along with other documentation and fee(s) that may be required, must be duly filed to become a registered home improvement contractor or subcontractor.

ADVERTISEMENT. Any commercial message in any newspaper, magazine, leaflet, flyer, catalog, display space in the telephone book, on radio, television, public address system, on the internet or made in person, by letter or other printed material, or any interior or exterior sign or display, including on a vehicle, which is delivered or made available to the public or a specific individual in any manner whatsoever.

APPLICANT. Any person who files an application to become registered as a home improvement contractor or subcontractor.

BBRS or Board. The State Board of Building Regulations and Standards.

CERTIFICATE. The document provided to the registrant which lists the certificate number and other information required by the director.

CERTIFICATE NUMBER. See registration number.

CLEAR AND CONSPICUOUS. The material representation being disclosed is of ten point type and is so presented as to be readily noticed and understood by a reasonable person. Language in the body of a contract is "conspicuous" if it is in larger or contrasting type or color, or underscored.

CONTRACT. Unless specifically noted otherwise in the text, a written agreement between a home improvement contractor and an owner contained in one or more documents for the performance of certain residential contracting work, including all labor, material, goods and services set forth under said agreement for a total amount exceeding \$1,000.00.

CONTRACTOR. Any person who, through himself or others, undertakes, offers to undertake, purports to have the capacity to undertake, or submits a bid for construction work. (See "home improvement contractor")

DIRECTOR. The administrator of the State Board of Building Regulations and Standards, or their designee(s).

EMPLOYEE. For the purposes of 780 CMR 110.R6 in determining the number of employees of an applicant for registration, any individual engaged in construction related activities who, in

the weekly pay period prior to the date of registration worked 20 or more hours for the registrant and for whom, the registrant withheld or was required to withhold federal or state income taxes and who, during the same pay period, was not otherwise paid or had such taxes withheld by any other registrant. Included would be all construction workers, supervisors, sales personnel, designers, estimators, active partners and officers of corporations.

FUND. The residential contractor's guaranty fund. See "guaranty fund."

FUND ADMINISTRATOR. the administrator of the residential contractor's guaranty fund, appointed by the secretary of the Office of Consumer Affairs and Business Regulation.

GUARANTY FUND. The residential contractor's guaranty fund. A fund out of which an owner, as defined herein, aggrieved by a registrant(s) may be paid part or all of their damages under rules and regulations promulgated by the secretary of the Office of Consumer Affairs and Business Regulation.

HOME IMPROVEMENT CONTRACTOR. Any person who owns or operates a contracting business who, through himself or others, undertakes, purports to have the capacity to undertake, offers to undertake, or submits a bid for residential contracting work to an owner, as such work is defined in 780 CMR 110.R6 and M.G.L. c. 142A, and such work for each project is in a total amount in excess of \$1,000.00, and is registered or required to be registered in accordance with M.G.L. c. 142A and 780 CMR 110.R6.

HOMEOWNER. See "Owner."

LOCAL CONSUMER GROUP. A local or regional agency which deals with the resolution of consumer problems and who is determined eligible by the attorney general under standards set by the attorney general in accordance with M.G.L. c. 12, § 11G.

MORTGAGE BROKER. Any person, who, for compensation or gain, or in the expectation of compensation or gain, directly or indirectly negotiates, places, assists in placement, finds or offers to negotiate, place, assist in placement of mortgage loans on residential property for others, or as otherwise defined in M.G.L. c. 255E.

MORTGAGE LENDER. Any person engaged in the business of making mortgage loans, or issuing commitments to fund mortgage loans, or accepting applications or fees associated with the making of mortgage loans which are secured by a mortgage on residential property, or as otherwise defined in M.G.L. c. 255E.

MORTGAGE LOAN. A loan to any person made primarily for personal, family, or household purposes, secured wholly or partially by a

mortgage on a residential property, or as otherwise defined by M.G.L. c. 255E.

OWNER. Any homeowner of a building which is an existing building at the time of a contract that is owner occupied, containing at least one but not more than four dwelling units, or a tenant authorized by the homeowner thereof, who orders, contracts for, or purchases the services of a contractor or subcontractor. An owner occupying a condominium unit in a building containing no more than four dwelling units qualifies as an owner under this definition, provided the owner owns a total of not more than four condominium units. A condominium association does not qualify as an owner.

OWNER-OCCUPIED. The residential building of at least one but not more than four dwelling units and occupied by the owner as a primary residence.

PERMIT. For the purposes of 780 CMR 110.R6, any construction-related permit, excluding any permits required by the owner which are not considered construction-related, such as zoning, environmental, historical commission, and the like.

PERSON. Any individual, partnership, corporation, society, trust, association, or any other legal entity.

REGISTRANT. Any duly registered home improvement contractor or subcontractor.

REGISTRATION NUMBER. The number assigned to the applicant after he has been approved for registration by the director and the Board of Building Regulations and Standards.

RESIDENTIAL CONTRACTING. The reconstruction, alteration, renovation, repair, modernization, conversion, improvement, removal or demolition or the construction of an addition to any pre-existing owner-occupied building containing at least one but not more than four dwelling units, which building or portion thereof is used or designed to be used as a residence or dwelling unit, or to structures which are adjacent and accessory to such residence or building, including but not necessarily limited to, garages, sheds, cabanas, poolhouses, gazebos.

SALESPERSON. any person, other than a supplier of materials or a laborer, who solicits, offers, negotiates, executes, or otherwise endeavors to procure by any means whatsoever, directly or indirectly, a contract for residential contracting services from an owner on behalf of a home improvement contractor or subcontractor.

SECRETARY. The secretary of the Office of Consumer Affairs and Business Regulations.

SUBCONTRACT. A contract, written or verbal, in any amount, between a home improvement contractor and a subcontractor or between two

subcontractors for the performance of any part of the home improvement contractor's or subcontractor's contract.

SUBCONTRACTOR. Any person, other than a supplier of only materials, who enters into a contract, written or verbal, with a home improvement contractor for the performance of any part of a home improvement contractor's contract with an owner for residential contracting, or who enters into a contract with any other subcontractor for the performance of any part of the subcontractor's contract.

110.R6.1.3 Scope.

110.R6.1.3.1 M.G.L. c. 142A and 780 CMR 110.R6 require the registration of persons who engage in residential contracting work as defined in 780 CMR 110.R6 and M.G.L. c. 142A after July 1, 1992, and define the requirements of M.G.L. c. 142A and enforcement of these requirements, as they pertain to home improvement contractors and subcontractors.

110.R6.1.3.2 Except for those persons who are specifically exempt from the provisions of 780 CMR 110.R6 and M.G.L. c. 142A, all contractors and subcontractors who engage in residential contracting as defined in 780 CMR 110.R6 and M.G.L. c. 142A shall be subject to and shall comply with 780 CMR 110.R6 and M.G.L. c. 142A.

110.R6.1.4 Administration and Enforcement.

110.R6.1.4.1 Director Responsibility. The director shall promulgate and enforce the provisions of 780 CMR 110.R6 and M.G.L. c. 142A as to all home improvement contractors and subcontractors who are registered or required to register.

110.R6.1.5 Persons Who Must Register.

110.R6.1.5.1 General. All home improvement contractors and subcontractors, as defined in 780 CMR 110.R6, except those exempt in 780 CMR 110.R6.1.6, shall register with the director by filing an application prescribed by the director.

110.R6.1.5.2 Designated Individual. In the case of registration by a corporation or partnership, an individual shall be designated to be responsible for the corporation's or partnership's residential contracting work.

110.R6.1.5.3 Liability. The corporation or partnership and its designee shall be jointly and severally liable for the payment of the registration fee, the payment to the guaranty fund, and for violations of any provisions of 780 CMR 110.R6, including actions by the registrant's employees, subcontractors or salespersons.

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110.R6.1.6 Persons Exempt from Registration or Renewal. Any person exempt from registration under 780 CMR 110.R6.1.6, and does not voluntarily register, is not subject to any of the provisions of 780 CMR 110.R6 or M.G.L. c. 142A. Persons exempt from registration are:

1. The Commonwealth or its political subdivisions;
2. Any school, public or private, offering as part of a vocational education program courses and training in any aspects of home construction or home improvements;
3. Electricians, plumbers, architects or any other persons who are required by law to attain standards of competency or experience as a prerequisite to licensure for and engaging in such trade or profession and who are acting exclusively within the scope of the profession for which they are currently licensed pursuant to such law, construction supervisors excepted.
4. Persons dealing in the sale of goods or materials who neither arrange to perform nor perform directly or indirectly any work or labor in connection with the installation of or application of the goods or materials;
5. Any owner personally doing residential contracting work on his/her own home;
6. Any individual who performs construction related labor or services for a home improvement contractor or subcontractor, for wages or salary and who does not act in the capacity of a home improvement contractor or subcontractor;
7. Any contractor or subcontractor who works on one residential contracting undertaking or project by one or more contracts where the aggregate contract price to the owner is less than \$500.00; provided, however, that the contract is not in an amount of less than \$500.00 for the purpose of evading 780 CMR 110.R6 or M.G.L. c. 142A.
8. Any person who engages in the business of a home improvement contractor or subcontractor on other than a full-time basis, and who has earned in gross revenues from residential contracting work, less than \$5,000.00 in the previous 12-month period;
9. Any person acting as a home improvement contractor or subcontractor who was enrolled as a full-time student in a secondary school or college with degree granting authority from the government of the state in which the school is located, for the immediately preceding academic semester and is also enrolled as a full-time student for the next academic semester, in the same or a similar degree granting secondary school or college provided that at least $\frac{2}{3}$ of the number of employees of the contractor or subcontractor are similarly enrolled in secondary schools or colleges and that the home improvement contractor or subcontractor does not reasonably expect to earn or does not in fact earn, in gross revenues, more

than \$5,000.00 from residential contracting work;

10. Persons who install any or all of the following:

- a. central heating,
- b. air-conditioning systems,
- c. energy-conservation devices, or
- d. provides conservation services conducted by or on behalf of a public utility under a program approved by the department of public utilities.

11. Any contractor or subcontractor who works exclusively in any of the following home improvement areas:

- a. landscaping;
- b. interior painting or wall covering;
- c. finished floor covering, including, but not limited to, carpeting, vinyl, tile, nonstructural hardwood;
- d. fencing or freestanding masonry walls;
- e. above-ground swimming pools;
- f. shutter or awning installation;
- g. ground level patios; includes flagstone, concrete, block, and wood set directly onto the ground; excludes decks which are supported above ground;
- h. asphalt and driveway installation and maintenance.

780 CMR 110.R6.2 REGISTRATION PROCEDURE

110.R6.2.1 Applicant Actions.

110.R6.2.1.1 Application. Each applicant for registration as a home improvement contractor or subcontractor shall submit a completed copy of an application form supplied by the director and necessary supporting documents to the director, along with such fees as required by the provisions of 780 CMR 110.R6.2.4, and M.G.L. c. 142A.

110.R6.2.1.2 Supporting Documentation. Supporting documentation shall include, as applicable:

1. For Corporations. An official document which lists the names and addresses of officers, directors, and major stockholders such as. A copy of the articles of incorporation, a current annual report as filed with the Secretary of State, a copy of the registration as a foreign corporation filed with the Secretary of State, or any other documentation which lists the names and addresses of officers, directors, and major stockholders, will be accepted in lieu of listing these names on the application.
2. For Partnerships. Either a copy of the current partnership agreement containing the requested information, or listing of the names and addresses of all partners on the application form.
3. For all Non-corporate Applicants. A copy of the business registration certificate filed with a city or town pursuant to M.G.L. c. 110,

§ 5, if applicable.

110.R6.2.1.3 Mailing Address. The application, supporting documentation and fees may be mailed or delivered as follows:

Director
Home Improvement Contractor Registration
One Ashburton Place, Room 1301
Boston, MA 02108

It shall be the responsibility of the applicant to assure that the required registration material is received by the director.

110.R6.2.1.4 Certified Check/Money Order. All applications shall be accompanied by the registration fee or by evidence of exemption, and by the fee for the guaranty fund. Fees shall be in the form of a money order or certified check. Two money orders or certified checks shall be included - one for the registration fee, if required, and one for the guaranty fund. Make checks or money orders payable to the Commonwealth of Massachusetts.

As noted in 780 CMR 110.R6.2.4.1.2, licensed individual construction supervisors and individual motor vehicle repair shops who desire to register are exempt from the registration fee only; there are no exemptions to the requirement for a contribution to the guaranty fund.

110.R6.2.1.5 Lost/Destroyed Certificate of Registration. Upon receipt of a nominal fee as established by the Commonwealth, and a completed affidavit provided by the director, that a certificate of registration has been lost or destroyed, a replacement certificate clearly identified as such, shall be issued by the director.

110.R6.2.1.6 Licensee Liabilities. The provisions of 780 CMR 110.R6 and those of M.G.L. c. 142A shall not be construed to relieve or lessen the responsibility of any person registered under 780 CMR 110.R6 and M.G.L. c. 142A or licensed under M.G.L. c. 143, § 94(i), nor shall the Commonwealth be deemed to have assumed any such liability by reason of the issuance of registration or licensure.

110.R6.2.2 Director's Action on Application.

110.R6.2.2.1 Issuance of Certificate. Upon receipt of a completed application form, supporting documentation, and the proper fee(s) therefor, the director shall ascertain whether such applicant meets all of the registration requirements and there are no grounds for rejection as specified in 780 CMR 110.R6.2.2.2; if all requirements are met, the Director, within 30 days of receipt of the application shall assign a registration number, with the approval of the BBRS; prepare and send by first class mail to such applicant, at the address stated on the registration form, a certificate indicating the applicant's registration number, name, address, name of the entity of the applicant, and such other

information as is deemed necessary by the director. The registration certificate is not transferable to any other person.

110.R6.2.2.2 Grounds for Refusal to Register or Renew. No application for registration or renewal conforming to 780 CMR 110.R6 and M.G.L. c. 142A may be denied except for a finding by the director that the applicant has done one or more of the following acts which are grounds for denial after the effective date of 780 CMR 110.R6.

1. Made material omissions or misrepresentations of fact on the home improvement contractor or subcontractor application for registration or renewal and supporting documentation or on an application for licensure or renewal under M.G.L. c. 143, § 94(i). (construction supervisor license);
2. Failed to pay either the registration fee or the payment to the fund as required under 780 CMR 110.R6.2.4.
3. Failed consistently to perform contracts or has performed said contracts in an unworkmanlike manner or has failed to complete said contracts with no good cause or has engaged in fraud or bad faith with respect to said contracts;
4. Failed to meet or has violated any of the requirements for registered home improvement contractors or subcontractors as defined in 780 CMR 110.R6, or has performed or is attempting to perform any act prohibited by 780 CMR 110.R6 and M.G.L. c. 142A.
5. Is under suspension or revocation of registration as a home improvement contractor or subcontractor;
6. Has failed to repay the guaranty fund for any payments made by the fund on the registrant's account.
7. Any act, set of circumstances, which demonstrate that it would be counter to the consumer protection aims of M.G.L. c. 142A to issue a registration.

110.R6.2.2.3 Application Refused. If the application is refused, the director shall, within 30 days of the application, notify the applicant in writing by first class mail of the reasons for the rejection.

110.R6.2.2.3.1. If applicable, the applicant may correct the deficiencies in the application material and return the corrected data to the director within ten days of the date of mailing of the director's notice of refusal, who will then assign a registration number and issue a certificate.

110.R6.2.2.3.2. If the grounds for rejection are based upon substantive grounds for refusal of 780 CMR 110.R6.2.2.2, and M.G.L. 142A, the applicant may request that the director reconsider the application as submitted by

stating his/her reasons therefore, in writing, within ten days of the date of mailing of the notice of the director's rejection of the application.

110.R6.2.2.4 Record Retention. The director shall keep a record of the date the application and all pertinent documents are received. In addition, the director shall keep on file, in convenient form and open to public inspection, all applications for registration, copies of certificates issued, and the names of all home improvement contractors or subcontractors whose registration has been revoked, suspended or surrendered.

110.R6.2.3 Duration of Registration.

110.R6.2.3.1 Initial Registration. Each such registration shall be in effect for two years from the date of issuance, unless suspended or revoked prior to that time, as provided in 780 CMR 110.R6 and M.G.L. c. 142A.

110.R6.2.3.2 Renewal of Registration. Not less than 90 days before the date of the expiration of such registration, the director shall send or cause to be sent, to each registered contractor or subcontractor, at the address on record, a notice for renewal of the registration and a copy of all forms necessary for such renewal, by first class mail, along with a schedule of such fees as are necessary for said renewal. Renewals will remain in effect for two years from date of renewal if not suspended or revoked prior to that time. The responsibility for timely renewal of registration remains with the registrant, notwithstanding this notice. An applicant shall submit a renewal application with fees within one year of the expiration date of the registration. Failure to submit a renewal application within this time period shall subject the applicant to a fee equal to the amount for initial registration.

110.R6.2.4 Fees to be Paid upon Registration or Renewal.

110.R6.2.4.1 Registration and Renewal Fee. All home improvement contractors and subcontractors, except those that are exempt from the registration or renewal fee in 780 CMR 110.R6.2.4.1.2, shall, at the time of registration or renewal, pay to the Commonwealth, a fee in the amount of the fee then being charged for the construction supervisor's license under M.G.L. c. 143, § 94(I).

110.R6.2.4.1.2 Exemptions from Registration and Renewal Fee.

1. Every individual construction supervisor licensed by the BBRS in accordance with M.G.L. c. 143, § 94(i), and every individual motor vehicle repair shop registered in accordance with M.G.L. c. 100A, § 2, who desires to be registered or renew their registration as a home improvement contractor

or subcontractor, and whose license or registration fee has been paid and is current, shall be deemed to have paid the registration fee required by 780 CMR 110.R6.2.4.1.

2. If the applicant is a corporation or partnership and the named individual responsible for home improvement contracting work is a licensed construction supervisor and a substantial owner (10% or more of ownership), the applicant entity is exempt from the registration and renewal fee.

110.R6.2.4.2 Contribution to Guaranty Fund-initial Registration. At the time of initial registration, contractors and subcontractors shall also pay to the Commonwealth, in a separate certified check or money order from the stated registration fee, if any, a fee payable to the guaranty fund.

110.R6.2.4.2.1. The fee paid by contractors and subcontractors to the guaranty fund shall be determined based on the number of employees (active construction-related personnel) of the home improvement contractor or subcontractor, as defined in 780 CMR 110.R6.1.2, on the date of initial registration, as follows:

1. Zero to three employees \$100.00
2. four employees up to and including ten \$200.00
3. 11 employees up to and including 30 \$300.00
4. More than 30 employees \$500.00

110.R6.2.4.2.2. The fee to the guaranty fund shall be paid by every registered home improvement contractor and subcontractor regardless of whether such registrant is exempt from paying the registration fee because of the home improvement contractor or subcontractor's status as a licensed construction supervisor or registered motor vehicle repair shop owner.

110.R6.2.4.2.3. Any registrant who fails to accurately determine the number of employees and pay the correct fee therefor shall be deemed to have failed to pay the fees required for registration and shall be subject to enforcement action by the director, in accordance with 780 CMR 110.R6.2.2.2, 4.1 and 4.3.

110.R6.2.4.2.4. No home improvement contractor or subcontractor shall be required to pay the contribution to the guaranty fund more than once unless the fund administrator determines that the amount of the fund is insufficient to maintain it at a level commensurate with claims made against the fund. If such a determination is so made, after conducting a public hearing, the director, in consultation with the fund administrator, may

assess each registered home improvement contractor or subcontractor an appropriate fee, the amount to be determined by the commissioner of administration and finance, which shall not exceed the amount of the original assessment; provided, however, that the director shall not assess any registrant more than once in any 12-month period.

110.R6.2.5 Responsibilities of Each Registrant.

110.R6.2.5.1 Changes in Status. Each registrant shall be responsible for reporting, in writing, within 30 days, changes in trade name or address or additions of business name(s), and any other pertinent changes in circumstances to the director.

110.R6.2.5.2 Display of Certificate Number. Every contract, building permit and advertisement for residential contracting as defined in 780 CMR 110.R6 shall display the home improvement contractor's or subcontractor's certificate of registration number.

110.R6.2.5.3 Return of Certificate. Upon the expiration, termination or voluntary surrender of a registration, the registrant shall deliver the certificate to the director who shall cancel the registration and endorse the date of expiration, termination or surrender. In such case, no further residential contracting work will be engaged in by the contractor or subcontractor.

780 CMR 110.R6.3 ENFORCEMENT AND COMPLAINT PROCEDURES

110.R6.3.1 Basis of Complaint. Only work performed pursuant to a contract between a homeowner and a contractor may be the basis of such complaint.

110.R6.3.2 Complaints. All complaints against a contractor must be in writing on a form provided by the director. Any person, building official, the Guarantee Fund administrator, or the Board may file a complaint. A complaint may allege wrongdoing against an HIC registration and a CSL holder on the same complaint form if the issues giving rise to the filing of the complaint are reasonably related. All complaints must be received by the Board within three years from the date the contract giving rise to the complaint was entered into by the parties.

110.R6.3.3 Review and Investigation of Complaints. Every complaint filed shall be reviewed by the director. If the director determines that the complaint alleges plausible potential violations by the contractor of 780 CMR or M.G.L. c. 142A, a hearing shall be convened. The director may investigate a complaint prior to scheduling a hearing. Failure of a complainant to cooperate in the investigation shall be grounds for dismissal of a complaint.

If a complaint alleges violations of 780 CMR 110.R5 in addition to allegations pursuant to the

provisions of 780 CMR 110.R6, one hearing may be held on all issues alleged provided that they all arise out of the same set of facts and circumstances.

Upon receipt of a complaint, the director shall send a letter acknowledging receipt to the complainant, the registration holder complained of, and the appropriate municipal building official. A copy of the complaint and all attachments shall be mailed to the registration holder with the acknowledgment letter.

110.R6.3.4 Notice of Hearing. If the director determines that a hearing shall be held to resolve a complaint, reasonable notice of the hearing shall be provided to the complainant and the complained of registration holder. Mailing of the notice to the address on record with the BBRs shall be deemed satisfactory notice to the registrant. The notice of hearing shall contain:

1. The name of the complainant.
2. The date, time and place of said hearing.
3. The location of the incident giving rise to the complaint.
4. Notice that either party may review the Board's complaint file by appointment.

110.R6.3.5 Hearing. Hearings held pursuant to this chapter shall be conducted pursuant to 801 CMR 1.02: *Informal/Fair Hearing Rules*. Any party may be represented by legal counsel. At the hearing, all parties shall be permitted to present an opening statement, testify on their own behalf, cross-examine all witnesses, present any relevant witness testimony, present any relevant documentary evidence, and offer a closing argument. The Hearing Officer may question any witness and include any records kept by the Board as exhibits. The Hearing Officer may, at their discretion, conclude the hearing at any time and issue a decision based on the evidence presented.

If a contractor does not appear for the hearing, the Hearing Officer may conduct a hearing and render a decision based upon the evidence presented only after making a finding that the contractor was provided reasonable notice of the hearing as required by 780 CMR 110.R6.3.4.

110.R6.3.6 Decisions and Discipline of License Holders. The Hearings Officer shall issue a written decision after the hearing. Decisions shall be issued in a reasonably prompt manner. The hearing officer may suspend a registration for a fixed period of time, revoke a registration permanently, or reprimand the registration holder. In conjunction with these disciplinary measures, the hearing officer may assess a fine of up to \$2000 for each violation found. Any registration that is suspended or revoked shall be forwarded to the Board immediately. A person or entity whose registration is revoked may apply in writing to the Board for reinstatement no sooner than two years from the date of the revocation.

110.R6.3.7 Cause for Reprimand, Suspension or Revocation. The following shall be grounds for reprimand, suspension or revocation of a home improvement contractor registration:

1. the applicant made a false statement on their application for registration;
2. a registrant made a false statement to the Board;
3. any violation of 780 CMR;
4. the registrant failed to fully cooperate with the director's investigation into a complaint;
6. the registrant failed to turn over a suspended registration to the director;
7. the registrant failed to abide by a mandate or order of the director or Board; or
8. the registrant committed an act prohibited by M.G.L. c. 142A, § 17 or any other provision of M.G.L. c. 142A.

110.R6.3.8 Appeal. Any person aggrieved by a decision of the Hearings Officer may, in writing, request review of said decision by the Board. The filing of such a petition shall not serve to stay any disciplinary action taken by the Hearings Officer. The Board may review such decision at its discretion. Such review is an administrative review that shall be based solely on the administrative record and is not to be construed as a second Hearing on the same complaint. After review, the Board may either deny the petition or remand the matter to the Hearings Officer for further proceedings as directed. The filing of an appeal with the Board shall serve to toll the timing provisions of M.G.L. c. 30A, § 14 until such time as a final decision is rendered by the Board.

780 CMR 110.R6.4 ENFORCEMENT ACTIONS

110.R6.4.1 Administrative Penalties. If the director determines that any registrant is liable for a violation of any of the provisions of 780 CMR 110.R6 or M.G.L. c. 142A, the director may institute one or more of the following actions.

110.R6.4.1.1 Allowable Actions.

1. Suspend the registrant's certificate of registration for such period of time as shall be determined by the director;
2. Revoke the registrant's certificate of registration;
3. Send a letter of reprimand to the registrant; and
4. Assess an administrative penalty not to exceed \$2,000.00, payable within 30 days of the date of the order of assessment, for each violation of any provisions of 780 CMR 110.R6 and M.G.L. c. 142A committed by the home improvement contractor(s) or subcontractor(s) who are registered or required to be registered under 780 CMR 110.R6. This penalty shall be deposited to the fund.

110.R6.4.1.2 Pendency of a Claim. The pendency of a claim against the fund shall not limit the director from taking enforcement action against any registrant pursuant to 780 CMR 110.R6 or M.G.L. c. 142A.

110.R6.4.2 Fines and Criminal Penalties.

110.R6.4.2.1 Sought by Attorney General or District Attorney. Fines and imprisonment specified in 780 CMR 110.R6 and M.G.L. c. 142A may be sought by the attorney general or a district attorney, and such fines and imprisonment shall be in addition to any administrative penalty otherwise applicable thereto.

110.R6.4.2.2 Operating Without a Certificate. Any home improvement contractor or subcontractor who shall knowingly, willfully, or negligently operate without obtaining a certificate of registration as required by 780 CMR 110.R6 and M.G.L. c. 142A and who is not otherwise exempt from the registration requirements or any home improvement contractor or subcontractor who continues to operate after revocation of or during suspension of, or who had failed to renew his certificate of registration, shall be punished by a fine not exceeding \$5,000.00 or imprisonment not exceeding two years or both.

110.R6.4.2.3 Other Violations. Any person who knowingly and willfully violates any of the provisions of 780 CMR 110.R6 or M.G.L. c. 142A, with respect to which a greater penalty is not otherwise provided by the provisions of 780 CMR 110.R6 or M.G.L. c. 142A or by any other law may be punished by a fine of not more than \$2,000.00 or by imprisonment for not more than one year or both.

110.R6.4.3 Injunctions, Restitution.

110.R6.4.3.1 Order from Superior Court. If the director concludes that the continuing conduct of any person alleged to be in violation of 780 CMR 110.R6 and M.G.L. c. 142A may result in substantial or irreparable harm to any citizen of the Commonwealth, the director may seek:

1. A permanent or temporary injunction with respect to the conduct from the superior court of any county in which the alleged violation is occurring, or in which the violator has its principal place of business; or
2. An order requiring restitution or satisfactory completion of the home improvement contractor's contract with an owner.

110.R6.4.3.2 Bond Not Required. The director shall not be required to file a bond or to show a lack of an adequate remedy at law when seeking an injunction under M.G.L. c. 142A against any person, association, partnership, or corporation not registered under 780 CMR 110.R6 and M.G.L. c. 142A.

110.R6.4.4 Prohibited and Deceptive Acts.

110.R6.4.4.1 Prohibited Acts. The following acts are prohibited by registered home improvement contractors or subcontractors, and those required to register under the provisions of 780 CMR 110.R6 and M.G.L. c. 142A.

1. Operating without a certificate of registration issued by the director;
2. Abandoning or failing to perform, without justification, any contract or project engaged in or undertaken, or deviating from or disregarding plans or specifications in any material way without the consent of the owner, except for changes in plans, specifications, or construction techniques required by building regulations;
3. Failing to credit the owner any payment they have made to the contractor or his salesperson in connection with a residential contracting transaction;
4. Making any material misrepresentation in the procurement of a contract or making any false promise of a character likely to influence, persuade or induce the procurement of contract;
5. Acting directly, regardless of the receipt or expectation of receipt of compensation or gain from the mortgage lender, in connection with a residential contracting transaction by preparing, offering or negotiating or attempting to or agreeing to prepare, arrange, offer or negotiate a mortgage loan on behalf of a mortgage lender;
6. Acting as a mortgage broker or agent for any mortgage lender;
7. Publishing, directly or indirectly, any advertisement relating to residential contracting which does not contain the home improvement contractor's or subcontractor's certificate of registration number or which does contain an assertion, representation or statement of fact which is false, deceptive, or misleading;
8. Advertising in any manner that a registrant is registered under 780 CMR 110.R6 unless the advertisement includes an accurate reference to the home improvement contractor's or subcontractor's certificate of registration;
9. Violating any of the building laws of the Commonwealth or of any political subdivision thereof;
10. Misrepresenting a material fact by an applicant in obtaining a certificate of registration;
11. Failing to notify the director of any change of trade name or address as required by 780 CMR 110.R6.2.5.1;
12. Conducting a residential contracting business in any name other than the one in which the home improvement contractor or

subcontractor is registered;

13. Failing to pay for materials or services rendered in connection with his/her operating as a home improvement contractor or subcontractor where he/she has received sufficient funds as payment for the particular construction work, project or operation for which the services or materials were rendered or purchased;

14. Failing to comply with any order, demand or requirement lawfully made by the director or fund administrator under and within the authority of 780 CMR 110.R6 and M.G.L. c. 142A;

15. Demanding or receiving payment in violation of 780 CMR 110.R6.5.2. Item 5, 6, or 5.2.2;

16. Violating any other provisions of 780 CMR 110.R6 and M.G.L. c. 142A;

17. Failing to pay to the guaranty fund in full, including interest, any amount paid from said fund because of the conduct of the registrant;

18. Any of the grounds for refusal to register or renew in 780 CMR 110.R6.2.2.2 are also considered prohibited acts;

19. Failing, within 21 days, to comply with, or advise the owner of intent to comply with, or appeal the decision of, an arbitrator as provided for in M.G.L.c. 142A and 201 CMR 14.00;

20. Failing to display the registration number on every contract, building permit and advertisement as required by 780 CMR 110.R6.5.2.1 Item 2, 110.R6.4.4.1 Item 2, 110.R6.4.4.2 Item 7, and 110.R6.4.4.2 Item 8.

110.R6.4.4.2 Deceptive Act. Violations of any of the provisions of 780 CMR 110.R6 and M.G.L. c. 142A shall constitute an unfair or deceptive act under the provisions of M.G.L. c. 93A.

780 CMR 110.R6.5 CONTRACTS

110.R6.5.1 Contract in Writing. Every agreement between a home improvement contractor and an owner to perform residential contracting services in an amount in excess of \$1,000.00 shall be in writing.

110.R6.5.2 Contents of Contract.

110.R6.5.2.1 Documents and Information. Every agreement to perform residential contracting services in excess of \$1,000.00 shall include, but not be limited to, the following documents and information:

1. The complete agreement between the owner and the contractor and a clear description of any other documents which are or shall be incorporated into said agreement;
2. The full names, federal ID number if applicable, (exclusive of social security number), address (exclusive of post office box addresses), registration number of the home improvement contractor, the name(s) of the

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salesperson(s), if any, who solicited or negotiated the contract and the date when said contract was executed by the parties;

3. The date on which the work under the contract is scheduled to begin and the date on which said work is scheduled to be substantially completed;

4. A detailed description of the work to be done and the materials to be used;

5. The total amount agreed to be paid for the work to be performed under the contract;

6. A time schedule of payments to be made under said contract and the amount of each payment stated in dollars, including all finance charges, if any. Any deposit required under the contract to be paid in advance of the commencement of work under said contract shall not exceed the greater of $\frac{1}{3}$ of the total contract price or the actual cost of any material or equipment of a special order or custom made nature, which must be ordered in advance of the commencement of the work, in order to assure that the project will proceed on schedule. No final payment shall be demanded until the contract is completed to the satisfaction of the parties thereto;

7. The signature of all parties shall be affixed to the contract;

8. There shall be a clear and conspicuous notice appearing in the contract stating:

a. That all home improvement contractors and subcontractors shall be registered by the director and that any inquiries about a contractor or subcontractor relating to a registration should be directed to.

Director
Home Improvement Contractor
Registration
One Ashburton Place, Room 1301
Boston, MA 02108

(617) 727-8598

b. The registration number of the home improvement contractor on the first page of the contract.

c. The owner's three-day cancellation rights under M.G.L. c. 93, § 48; M.G.L. c. 140D, § 10 or M.G.L. c. 255D, § 14, as may be applicable.

d. All warranties and the owner's rights under the provisions of 780 CMR 110.R6 and M.G.L. c. 142A;

e. In ten point bold type or larger, directly above the space provided for the signature, the following statement.

DO NOT SIGN THIS CONTRACT IF
THERE ARE ANY BLANK SPACES

f. Whether any lien or security interest is on the residence as a consequence of the contract.

9. An enumeration of such other matters upon which the owner and the contractor may lawfully agree; provided, however that no such agreement may waive any rights conveyed to the owner under the provisions of 780 CMR 110.R6 and M.G.L. c. 142A;

10. Any other provision otherwise required by the applicable laws of the Commonwealth.

110.R6.5.2.2 Permit Notice. Any contract entered into between a home improvement contractor and an owner shall contain a clause informing the owner of the following:

1. Any and all necessary construction-related permits;

2. That it shall be the obligation of the home improvement contractor to obtain such permits as the owner's agent;

3. That owners who secure their own construction-related permits or deal with

unregistered contractors will be excluded from the guaranty fund provisions of M.G.L. c. 142A;

110.R6.5.2.3 Acceleration of Payment. No contract shall contain an acceleration clause under which any part or all of the balance not yet due may be declared due and payable because the holder deems himself to be insecure. However, where the contractor deems himself to be insecure he/she may require as a prerequisite to continuing said work that the balance of funds due under the contract, which are in the possession of the owner, shall be placed in a joint escrow account requiring the signatures of the home improvement contractor and owner for withdrawal.

110.R6.5.2.4 Copy to Owner. At the time of signing, the owner shall be furnished with a copy of the contract signed by both the home improvement contractor and the owner. No work shall begin prior to the signing of the contract and transmittal to the owner of a copy of such contract.

110.R6.5.2.5 Arbitration. Any contract entered into between a home improvement contractor and owner may provide that the home improvement contractor may initiate alternative dispute resolution through any private arbitration services approved by the secretary, as provided in M.G.L. c. 142A; provided, that said alternative dispute resolution provision is clearly and conspicuously disclosed in the contract, in language designated by the secretary, and that each party separately signs and dates the provision, thereby assenting to the procedure. The following language and format is acceptable.

THE CONTRACTOR AND THE HOMEOWNER HEREBY MUTUALLY AGREE IN ADVANCE THAT IN THE EVENT THE CONTRACTOR HAS A DISPUTE CONCERNING THIS CONTRACT, THE CONTRACTOR MAY SUBMIT SUCH DISPUTE TO A PRIVATE ARBITRATION SERVICE WHICH HAS BEEN APPROVED BY THE SECRETARY OF THE OFFICE OF CONSUMER AFFAIRS AND BUSINESS REGULATIONS AND THE CONSUMER SHALL BE REQUIRED TO SUBMIT TO SUCH ARBITRATION AS PROVIDED IN M.G.L. c. 142A.

Contractor

Owner

NOTICE: THE SIGNATURES OF THE PARTIES ABOVE APPLY ONLY TO THE AGREEMENT OF THE PARTIES TO ALTERNATIVE DISPUTE SETTLEMENT

INITIATED BY THE CONTRACTOR. THE OWNER MAY INITIATE ALTERNATIVE DISPUTE RESOLUTION EVEN WHERE THIS SECTION IS NOT SEPARATELY SIGNED BY THE PARTIES.

110.R6.5.3 Dispute Resolution.

110.R6.5.3.1 Court Action. Any party may bring an action to enforce any provisions of 780 CMR 110.R6 and M.G.L. c. 142A, in superior court, the district court, or the small claims division of the district court.

110.R6.5.3.2 Owner Right to Arbitration. In the alternative, an owner may request that a dispute resulting from and relating to residential contracting be decided under the terms of a private arbitration service approved by the secretary.

110.R6.5.3.3 Contractor Right to Arbitration. The home improvement contractor may initiate dispute resolution through private arbitration services approved by the secretary, provided that the contract between the owner and the home improvement contractor contains such a clause as provided in 780 CMR 110.R6.5.2.5.

110.R6.5.4 Validity of Contract. Contracts which fail to comply with the requirements of 780 CMR 110.R6 and M.G.L. c. 142A shall not be invalid solely because of noncompliance.

780 CMR 110.R6.6 SUPPLEMENTARY IDENTIFICATION CARDS

110.R6.6.1 Definitions.

Certificate of Registration. The document issued by the Director showing the registrant's certificate number and other data as required by the director.

Identification Card. The document issued to the responsible individual or to one or more individuals in the employ of the applicant/registrant.

110.R6.6.2 Certificates of Registrants. For applicants registering as individuals, the certificate of registration and identification card will be issued in the name of the registrant. Only one identification card will be issued to individual registrants.

110.R6.6.2.2 Non-individual Registrants.

110.R6.6.2.2.1 If the Applicant is a corporation, partnership, proprietorship with a fictitious name, or other non-individual entity, the certificate of registration and the initial identification card will bear the name of the registrant entity and the individual responsible for the home improvement residential contracting activities of the registrant.

110.R6.6.2.2.2 Supplementary identification cards may be issued, upon request of the

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registrant, to named officers, partners, of key individuals in the employ of the registrant under the certificate of registration number of the applicant entity, upon submission of the appropriate request form and fee. The applicant is responsible for the prompt return of individual identification cards if there is a change in status of individuals holding such supplementary cards.

110.R6.6.3 Fees. For each additional identification card request in accordance with 780 CMR

110.R6.2.2.1, an additional fee per card in an amount of \$10.00 must accompany the request for additional cards.

110.R6.6.4 Expiration. Supplementary cards will expire on the same date as the expiration date of the registrant entity, and must be renewed along with the renewal of the registrant entity's registration by submission of the required application and fee of \$10.00 per card requested.

CERTIFICATION OF INSPECTORS OF BUILDINGS, BUILDING COMMISSIONERS AND LOCAL INSPECTORS

(Note: This Regulation is unique to Massachusetts)

FORWARD

Contained in 780 CMR R7 are the *rules and regulations* for the certification of all inspectors of buildings, building commissioners and local inspectors (collectively referred to as building code enforcement officials) of the Board of Building Regulations and Standards (BBRS). In accordance with M.G.L. c. 143, §§3 and 94, the BBRS is authorized to adopt rules and regulations which govern the administration of such program..

780 CMR 110.R7.1 General Provisions

- 110.R7.1.1 Title
- 110.R7.1.2 Definitions
- 110.R7.1.3 Scope, intent
- 110.R7.1.4 Powers and duties
- 110.R7.1.5 Inspector Certification Advisory Committee (Building Official Certification Committee)
- 110.R7.1.6 Categories of certification
- 110.R7.1.7 Certifications required

780 CMR 110.R7.1 General Provisions

- 110.R7.2 Requirements for Initial Certification
- 110.R7.2.1 Application
- 110.R7.2.2 Building Code Enforcement Officials in office as of November 12, 1992
- 110.R7.2.3 After November 12, 1992
- 110.R7.2.4 Requirements for certification as a local inspector
- 110.R7.2.5 Requirements for certification as an inspector of buildings/building commissioner

780 CMR 110.R7.3 Requirements for Maintenance of Certification

- 110.R7.3.1 Continuing education
- 110.R7.3.2 Renewal of certification
- 110.R7.4 Procedures for Complaints
- 110.R7.4.1 Complaints
- 110.R7.4.2 Revocation of certificates and alternate sanctions
- 110.R7.4.3 Violations and penalties

780 CMR 110.R7.1 GENERAL PROVISIONS

110.R7.1.1 Title. 780 CMR 110.R7 entitled *Certification of Inspectors of Buildings, Building Commissioners and Local Inspectors* (hereinafter collectively referred to as Building Code Enforcement Officials) is authorized and promulgated by the State Board of Building Regulations and Standards under the authority of M.G.L. c. 143, §§ 3 and 94.

110.R7.1.2 Definitions. Any terms not herein defined shall assume the definition of the term as used elsewhere in 780 CMR.

BBRS. State Board of Building Regulations and Standards

REGISTRANT. Any individual registered with the Board of Building Regulations and Standards (BBRS) as a building code enforcement official in the capacity of an inspector of buildings/building commissioner or local inspector.

110.R7.1.3 Scope, Intent. 780 CMR 110.R7 shall control all matters relating to qualifications and certification of all building code enforcement officials engaged in or to be engaged in the administration and enforcement of 780 CMR; categories of certified building code enforcement officials; procedures for application, issuance, denial and revocation of certifications; approval of training and/or educational programs offered to meet the requirements for certification; maintenance of certification through continuing education; application fees for certification; and enforcement of 780 CMR 110.R7.

It is the purpose of 780 CMR 110.R7 to establish standards and procedures for certification, and to require all persons performing duties with respect to the inspection of building construction for any political subdivision within the Commonwealth to be certified as provided in 780 CMR 110.R7.

110.R7.1.4 Powers and Duties. The BBRS, working through the Administrator and the Board staff, shall have the following responsibilities in addition to all others provided in 780 CMR and 780 CMR 110.R7.

110.R7.1.4.1. Upon recommendations from the Building Official Certification Committee, established under 780 CMR 110.R7.1.5, to issue certifications to individuals deemed qualified as provided for herein.

110.R7.1.4.2. To maintain accurate records of all applications for certification and any official action thereon and to make such records available for inspection by the public at all reasonable times.

110.R7.1.4.3. To suspend or revoke a certification provided for herein upon the establishment of good cause as defined by 780 CMR 110.R7.4.2.

110.R7.1.4.4. Any person aggrieved by any notice, action, ruling or order of the Board, or the Building Official Certification Committee with respect to 780 CMR 110.R7, may have a right to

a hearing as provided for by law.

110.R7.1.5 Inspector Certification Advisory Committee (Building Official Certification Committee):

110.R7.1.5.1. There is hereby established in the BBRS the Inspector Certification Advisory Committee hereafter known as the *Building Official Certification Committee*. This Committee shall be supported by such staff of the BBRS as may be required for the effective operation of 780 CMR 110.R7.

110.R7.1.5.2 Powers and Duties. The Building Official Certification Committee shall have the responsibility to advise and to recommend to the BBRS on all items relating to the certification of building code enforcement officials, including, but not limited to:

1. Issuing certificates
2. Reviewing applicant credentials
3. Maintaining applicant and certified inspector records
4. Hearing complaints and appeals pertaining to inspector certification
5. Reviewing and approving all courses of study, seminars, and other educational programs as deemed necessary, for continuing education requirements.
6. Monitoring all appointments to assure compliance with 780 CMR 110.R7.
7. Considering reciprocity with other states (upon petition of the Building Official Certification Committee on forms provided for such purpose).

110.R7.1.5.3 Make-up of the Committee. The Building Official Certification Committee shall consist of nine members appointed by the BBRS as follows: (Terms of committee members are as established by lot at the March 31, 1993 meeting.)

1. One member of the BBRS or his or her designee
2. Six members who are active building officials consisting of:
 - a. One member from each of the three Municipal Building Official's Associations (Southeastern Building Officials Association, Building Officials of Western Massachusetts, Massachusetts Building Commissioners and Inspectors Association).
 - b. Three members at large to be appointed by the BBRS.
3. One member from academia who is an educator of construction at the college level (e.g. architectural, civil, structural) to be appointed by the BBRS.
4. One member of the Massachusetts Municipal Association.

110.R7.1.6 Categories of Certification.

110.R7.1.6.1. Categories of certification for building code enforcement officials are as follows:

110.R7.1.6.1.1 Inspector of Buildings or Building Commissioner. An individual certified as an inspector of buildings/building commissioner shall perform the duties as defined in 780 CMR 106 of the *Sixth Edition of the Massachusetts State Building Code*, 780 CMR 5106 and M.G.L. c. 143, as applicable.

110.R7.1.6.1.2 Local Inspector. An individual certified as a local inspector shall perform the duties as defined in 780 CMR 106 of the *Sixth Edition of the Massachusetts State Building Code*, 780 CMR 5106 and M.G.L. c. 143, as applicable.

110.R7.1.6.1.3 Conditional Appointment of a Building Code Enforcement Official. A conditional appointee shall meet the requirements of 780 CMR 110.R7.1.7.4 through 780 CMR 110.1.7.6.3.

110.R7.1.6.1.4 Alternate Inspectors of Buildings/Building Commissioners. An alternate inspector of buildings/building commissioner shall be certified prior to appointment.

110.R7.1.7 Certifications Required.

110.R7.1.7.1. After November 12, 1992, no individual shall be permanently appointed to the position of inspector of buildings, building commissioner or local inspector in a municipal enforcing agency for which a certification requirement has been established by 780 CMR 110.R7, unless that individual has been deemed qualified and certified in that category by the Building Official Certification Committee.

110.R7.1.7.1.1 Conditional Appointments. Conditional appointments may be made pursuant to 780 CMR 110.R7.1.7.4, 1.7.5 and 1.7.6.

110.R7.1.7.2 Reporting by Appointing Authorities. Immediately following appointment, the clerk of each city or town shall report to the BBRS, the name, title and status of each new employee who is appointed as an inspector of buildings, building commissioner or local inspector. Said report shall be provided on forms as prescribed by the BBRS for said purpose and shall be submitted in attestation under the pains and penalties of perjury that said new employee meets or exceeds the minimum qualifications as defined by M.G.L. c. 143, § 3 and 780 CMR 105.3, 105.4 of the *Sixth Edition of the Massachusetts State Building Code*, 780 CMR 5105.3 and 5105.4, as applicable.

110.R7.1.7.3 Historical Note. Any individual employed as inspector of buildings, building

commissioner or local inspector and who was in office on November 12, 1992 and who was qualified (in accordance with M.G.L. c. 143, § 3) to be in office at time of hire, and who presented acceptable evidence of these facts to the BBRS, shall be deemed certified in the category held on said date, and shall be provided with a certificate by the BBRS.

110.R7.1.7.4 Conditional Appointments. After November 12, 1992, individuals who meet or exceed the experience requirements pursuant to M.G.L. c. 143, § 3 and 780 CMR, but who are not certified under the provisions of 780 CMR 110.R7 may be appointed on a conditional basis only.

110.R7.1.7.5 Regulations for the conditional appointment of Building Code Enforcement Officials.

110.R7.1.7.5.1. Any individual conditionally appointed as a building code enforcement official, on or after November 12, 1992 who is not certified in the appropriate category at the time of the conditional appointment; shall comply with the following:

1. Immediately upon appointment, the city or town clerk shall report the conditional appointment to the BBRS in accordance with 780 CMR 110.R7.1.7.2.
2. Within the first six months of employment the conditional appointee shall make application to take the examination(s) required for the appropriate category of certification as identified in 780 CMR 110.R7.2.0.
3. Within one year following the first six months of employment a conditional appointee who is appointed as an inspector of buildings\building commissioner shall attain a passing score on all of the examinations required for that category of certification.
4. Within six months following the first six months of employment a conditional appointee who is appointed as a local inspector shall attain a passing score on all of the examinations required for that category of certification.
5. In accordance with 780 CMR 110.R7.1.7.6, a conditional appointee may petition the Building Official Certification Committee in writing for an extension of time to comply with the examination schedule of 780 CMR 110.R7. Upon establishment of cause, the Building Official Certification Committee may grant such extensions of time as it may consider appropriate as detailed in 780 CMR 110.R7.1.7.6.

110.R7.1.7.5.2. Conditional appointees shall notify the BBRS of any change in the status of their employment, within one month of such

change.

110.R7.1.7.6 Requests for Extensions of Time to Comply with Examination Schedules.

110.R7.1.7.6.1. Upon written petition to the Building Official Certification Committee, any conditional appointee unable to comply with the examination schedule as cited in 780 CMR 110.R7.1.7.5 may for cause, be granted an extension of time in order to comply. Petitions shall be forwarded to the clerk of said committee on forms for such purpose, and addressed to the office of the BBRS. The conditional appointee shall state all reasons to substantiate the request for an extension of time. Conditional appointees who have not attempted the examination schedule as herein defined during the prescribed period shall not be granted an extension, and no conditional appointee shall be afforded more than three extensions of time beyond the prescribed period for the level of certification sought.

110.R7.1.7.6.2. The Building Official Certification Committee shall, within ten days of any action taken by the committee pursuant to 780 CMR 110.R7, notify the appointing authority in writing of such action.

780 CMR R7.2 REQUIREMENTS FOR INITIAL CERTIFICATION

110.R7.2.1 Application. Any candidate for certification in any category of building code enforcement official issued pursuant to 780 CMR 110.R7 shall submit an application to the BBRS, accompanied by the required application fee (if any), on forms provided for this purpose by the BBRS. The application shall include such information and documentation as the BBRS may require pursuant to 780 CMR 110.R7.

110.R7.2.2 Building Code Enforcement Officials in Office as of November 12, 1992 (Historical Note). Upon receipt of acceptable evidence as established by the BBRS, signed by the city or town clerk and the appointing authority in attestation that the applicant for certification was employed in the position of inspector of buildings, building commissioner or local inspector and met the qualification requirements of said position pursuant to M.G.L. c. 143, § 3 and 780 CMR as of the date of hire, the applicant shall be deemed certified in the applicable category and shall be issued a certificate. The certificate shall indicate the name of the individual and the category of certification and other information as may be deemed necessary by the BBRS.

110.R7.2.3. After November 12, 1992, applicants for certification as a Building Code Enforcement Official shall meet the requirements of 780 CMR 110.R7.2.4

110.R7.2.4 Requirements for Certification as a Local Inspector:

110.R7.2.4.1 All candidates shall meet or exceed the qualifications for the position of local inspector pursuant to M.G.L. c. 143, § 3 and 780 CMR prior to taking any examinations. The Board of Building Regulations via the certification committee shall approve all candidates prior to taking any examinations. The certification committee shall maintain a list of all qualified candidates for any and all city and towns appointing building officials.

110.R7.2.4.2. All candidates shall attain a passing score in all examinations required for certification as either a Building Plans Examiner (identified as Exams 1B, 1C, 3B and 3C) or Building Inspector (identified as Exams 1A, 1B and 3B) as defined by the National Certification Program for Construction Code Inspectors (NCPCCI) or equivalent exam categories as approved by the BBRS for such purpose and as offered by the International Code Council (ICC).

110.R7.2.4.3 Prior approval for examination as a Local Inspector. No candidates shall be allowed to take said examinations without prior approval of the Board of Building Regulations and Standards or the certification committee at the Board's discretion.

110.R7.2.5 Requirements for Certification as an Inspector of Buildings/Building Commissioner.

110.R7.2.5.1. All candidates shall meet or exceed the qualifications for the position of inspector of buildings/building commissioner pursuant to M.G.L. c. 143, § 3 and 780 CMR prior to any examinations. The Board of Building Regulations and Standards via the certification committee shall approve all candidates prior to taking any examinations. The certification committee shall maintain a list of all qualified candidates for any and all city and towns appointing building officials.

110.R7.2.5.2. All candidates shall meet the examination requirements for certification as a local inspector pursuant to 780 CMR 110.R7.2.4.2, or hold a certification as a local inspector pursuant to 780 CMR 110.R7.2.2.

110.R7.2.5.3. All candidates shall attain passing scores in all examinations required for certification as a Certified Building Official as defined by the Certified Building Official Program of the Council of American Building Officials (CAB O) or equivalent exam categories as approved by the BBRS for such purpose and as offered by the International Code Council (ICC).

110.R7.2.5.4 Prior Approval for Examination as an Inspector of Buildings/Building Commissioner. No candidates shall be allowed to take said examinations without prior approval of the Board of Building Regulations and

Standards or the certification committee at the Board's discretion.

110.R7.2.6 Retired Persons. Any person who has been duly certified in accordance with 780 CMR 110.R7 and who retires from service in good standing, may petition the committee to receive "retired status" certification. Upon approval said certification shall be denoted "retired" and shall not be deemed revoked. Revocation shall only be invoked for cause. Any person who has been approved for "retired status" certification and who wishes to reactivate said certification shall comply with the examination schedule as defined in 780 CMR 110.R7 for the level of certification sought.

780 CMR 110.7.3 REQUIREMENTS FOR MAINTENANCE OF CERTIFICATION STATUS

110.R7.3.1 Continuing Education.

110.R7.3.1.1. Within each three year period following initial certification, the registrant shall complete 45 hours of continuing education credit acceptable to the Building Official Certification Committee. Conditional appointees as defined by 780 CMR 110.R7 shall attain at least one contact hour of education credit for each month of employment until such time as the conditional appointee has successfully completed the required examination schedule and is certified as prescribed.

110.R7.3.1.2. The Committee may publish a list of acceptable educational programs, courses, seminars, and the like. The Committee may also accept educational activities in which registrants have participated after the fact, upon application and review of the course information. The Committee shall assign credits to each educational/training event. The Committee shall issue policies and procedures, separate from 780 CMR 110.R7 relative continuing education requirements.

110.7.3.2 Renewal of Certificate.

110.R7.3.2.1 Term of Certificate. Each certified individual shall maintain a record of his/her continuing education. Credit hours shall be reported to the BBRS or other approved agencies as prescribed by the Committee's policies and procedures relative to continuing education. The BBRS shall maintain a record of each inspector's progress.

At the end of each three year period, each inspector who has successfully maintained his/her continuing education credit shall be duly notified by the BBRS.

110.R7.3.3. In accordance with M.G.L. c. 143, § 99, no building code enforcement official attending BBRS required educational programs, shall lose any

rights relative to compensation or vacation.

780 CMR 110.R7.4 PROCEDURES FOR COMPLAINTS

110.R7.4.1 Complaints.

110.R7.4.1.1 Cause for Complaint. Any registrant who has been judged to have violated the provisions of 780 CMR 110.R7 or 780 CMR by a competent court having jurisdiction or has been judged to have violated procedures as defined by the State Ethics Commission for acts pertinent to his/her performance as a certified building code enforcement official may be entitled to a hearing in accordance with M.G.L. c. 30A before the Building Official Certification Committee or subcommittee thereof in respect to retention of his/her certification.

Exception: The BBRS and/or members of the Building Official Certification Committee or sub-committee thereof, may convene hearings for those registrants who fail to attain continuing education credits as defined by 780 CMR 110.R7.7.3.

110.R7.4.1.2 Hearings on Complaints. If a hearing is to convene, the committee shall give at least ten days notice to all those party to the complaint. The sending of notice to the address recorded on the records of the BBRS shall be deemed sufficient notice.

110.R7.4.1.3 Notice of Hearings. The notice shall contain:

1. The name of the complainant
2. A copy of the complaint
3. The date, time and place of said hearing.

The complete file of complaint shall be available for inspection at the office of the BBRS during regular business hours. Parties may present written or oral evidence to refute or mitigate any charge contained in the complaint and present witnesses in his or her behalf. In the event that the committee votes to take action against said certification pursuant to this hearing, the building code enforcement official, upon notice of the decision, shall immediately comply with said action.

110.R7.4.1.4 Continuation of Hearings. the committee, in its discretion, may continue the date for hearing upon request by building official, the complainant or the committee itself.

110.R7.4.1.5 Timing of Decisions. The committee shall make a decision within 15 days of the hearing. A written decision shall be issued within 30 days of the hearing date.

110.R7.4.1.6 Decisions. The decision shall be final and binding upon the building code enforcement official and the complainant.

110.R7.4.1.7 Notice of Action. In the event that the committee votes to take action against said

certification pursuant to this hearing, the building code enforcement official, upon notice of the decision, shall immediately comply with said action.

110.R7.4.1.8 Appeal. Any person aggrieved by a decision of the committee may appeal such decision to a court of law or equity in conformance with M.G.L. c. 30A, § 14.

110.R7.4.2 Revocation of Certificates and Alternative Sanctions.

110.R7.4.2.1. The BBRS, upon recommendation of the Committee, and subject to the requirements of Administrative Practices as defined by M.G.L. c. 30A, may suspend or revoke a certification, or assess any other penalties as provided for by law, if it is determined that the registrant: (The following is not an exhaustive list.)

1. Has obtained a certification by fraud or misrepresentation, or the person named in the certificate has obtained it by fraud or misrepresentation as judged by members of the Building Official Certification Committee following a hearing on such matters;
2. Has aided or abetted in practice as a certified building code enforcement official any person not authorized to practice as a certified building code enforcement official under the provisions of 780 CMR 110.R7 as judged by members of the Building Official Certification Committee following a hearing on such matters;
3. Has fraudulently or deceitfully practiced as a certified building code enforcement official as judged by the State Ethics Commission and/or a competent court having jurisdiction and following a hearing before members of the Building Official Certification Committee on such matters;
4. Has been grossly negligent or has engaged in misconduct in the performance of any of his or her duties as judged by the State Ethics Commission and/or a competent court having jurisdiction and following a hearing before members of the Building Official Certification Committee on such matters;
5. Has failed, over a period of time, to maintain continuing education requirements as specified in 780 CMR 110.R7 as judged by members of the Building Official Certification Committee following a hearing on such matters;
6. Has been found to have failed to report an offer, or bribe, or other favor in a proceeding under 780 CMR 110.R7 or other appropriate law of this or any other state or jurisdiction as judged by the State Ethics Commission and/or a competent court having jurisdiction and following a hearing before members of the Building Official Certification Committee on such matters;

7. Has made a false or misleading statement, or has made a material omission in any submission to the BBRS as judged by members of the Building Official Certification Committee following a hearing on such matters;

8. Has failed to enforce the provisions of 780 CMR as prescribed by M.G.L. c. 143, § 3 as judged by the State Ethics Commission and/or a competent court having jurisdiction and following a hearing before members of the Building Official Certification Committee on such matters.

110.R7.4.3 Violations and Penalties.

110.R7.4.3.1. It shall be a violation of 780 CMR 110.R7 on or after November 12, 1992, for any individual to represent himself or herself to be qualified for a position that the individual does not currently hold, or to use a title or otherwise represent himself or herself to be qualified for a position that the individual does not currently hold, or to use a title or otherwise represent himself or herself as certified or authorized to act under the 780 CMR if that individual does not possess a certificate, unless such person is appointed subject to the provisions of 780 CMR 110.R7.1.6.1.3. In addition to any other remedy available under law, such representation shall be deemed a violation of 780 CMR 110.R7 and any other penalties as provided for by law.

110 R7.4.3.2. It shall be a violation of 780 CMR 110.R7 on and after November 12, 1992, for any local enforcing agency to offer employment, to

retain for employment or to permanently appoint any individual who is not certified in accordance 780 CMR 110.R7, except on a conditional basis in accordance with 780 CMR 110.R7.1.6.1.3.

110.R7.4.3.3. No person whose certification has been revoked in accordance with procedures established by 780 CMR 110.R7 shall approach the Board for certification or re-certification until a period of at least one year has elapsed from the date of revocation. (The date of revocation shall be defined as the date that appears on the written decision relating to the case.) Any person applying for certification or recertification under these procedures shall be viewed as a first time candidate for certification and shall meet or exceed all applicable requirements of 780 CMR, 780CMR 110.R7 and Massachusetts General Law pertaining to the certification process; including but not limited to minimum qualifications defined for the positions of inspector of buildings building commissioner and local inspector. In addition no person whose certification has been revoked in accordance with procedures established by 780CMR 110.R7 shall approach the Board for certification or recertification without first complying with the examination schedule as herein defined in 780 CMR 110.R7 for the level of certification sought. Upon review of the matter by members of the BBRS and/or members of the Building Official Certification Committee, certification may be issued or reissued. However, the Board may permanently revoke a certification, for cause.

(780 CMR 111.00 THROUGH 119.00: RESERVED)

(PAGES 975 THROUGH 980 ARE RESERVED FOR FUTURE USE.)

Part XII — Appendices

780 CMR 120.00

780 CMR 120.A

EMPLOYEE QUALIFICATIONS

(Note: 780 CMR 120.A is unique to Massachusetts)

**780 CMR 120.A101 BUILDING OFFICIAL
QUALIFICATIONS.**

120.A101.1 Inspector of Buildings/Building Commissioner. The requirements/qualifications for the inspector of buildings/building commissioner are set forth in M.G.L. c. 143, § 3,

supplemented by 780 CMR 110.R7

120.A101.2 Building Inspector. The requirements/qualifications for the building inspector are set forth in M.G.L. c. 143, § 3, supplemented by 780 CMR 110.R7.

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780 CMR 120.B

BOARD OF APPEALS

(Note: 780 CMR 120.B is unique to Massachusetts)

780 CMR 120.B101 GENERAL

120.B101.1 Scope. Refer to M.G.L. c. 143, § 100 and 780 CMR 122.0 or 780 CMR 5122.0, as applicable, for requirements regarding appealing the interpretation, order, requirement, direction or failure to act by any state or local agency or any

person or state or local agency charged with the administration or enforcement of the state building code or any of its rules and regulations, except for the specialized codes as described in M.G.L. c. 143, § 96.

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780 CMR 120.C

GROUP U AGRICULTURAL BUILDINGS

780 CMR 120.C101 GENERAL

120.C101.1 Scope. The provisions of 780 CMR 120.C shall apply exclusively to agricultural buildings. Such buildings shall be classified as Group U and shall include the following uses:

1. Livestock shelters or buildings, including shade structures and milking barns.
2. Poultry buildings or shelters.
3. Barns.
4. Storage of equipment and machinery used exclusively in agriculture.
5. Horticultural structures, including detached production greenhouses and crop protection shelters.
6. Sheds.
7. Grain silos.
8. Stables.

780 CMR 120.C102 ALLOWABLE HEIGHT AND AREA

120.C102.1 General. Buildings classified as Group U Agricultural shall not exceed the area or

height limits specified in Table 120.C102.1.

120.C102.2 One-story Unlimited Area. The area of a one-story Group U agricultural building shall not be limited if the building is surrounded and adjoined by public ways or yards not less than 60 feet (18288 mm) in width.

780 CMR 120.C103 MIXED OCCUPANCIES

120.c103.1 Mixed Occupancies. Mixed occupancies shall be protected in accordance with 780 CMR 3.00.

780 CMR 120.C104 EXITS

120.C104.1 Exit Facilities. Exits shall be provided in accordance with 780 CMR 10.00 and 11.00.

Exceptions:

1. The maximum travel distance from any point in the building to an approved exit shall not exceed 300 feet (91440 mm).
2. One exit is required for each 15,000 square feet (1393.5 m²) of area or fraction thereof.

**TABLE 120.C102.1 – BASIC ALLOWABLE AREA FOR GROUP U,
ONE STORY IN HEIGHT AND MAXIMUM HEIGHT OF SUCH OCCUPANCY**

I		II		III and IV		V	
A	B	A	B	IIIA and IV	IIIB	A	B
ALLOWABLE AREA (square feet)^a							
Unlimited	60,000	27,100	18,000	27,100	18,000	21,100	12,000
MAXIMUM HEIGHT IN STORIES							
Unlimited	12	4	2	4	2	3	2
MAXIMUM HEIGHT IN FEET							
Unlimited	160	65	55	65	55	50	40

For SI: 1 square foot = 0.0929 m²

a. See 780 CMR 120.C102 for unlimited area under certain conditions.

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780 CMR 120.D
RESERVED

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780 CMR 120.E

SUPPLEMENTARY ACCESSIBILITY REQUIREMENTS

(Note: 780 CMR 120.E is unique to Massachusetts)

780 CMR 120.E101 GENERAL

120.E101.1 Scope. For conformance to Massachusetts accessibility requirements refer to 521 CMR and 780 CMR 1007.

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780 CMR 120.F

RODENT PROOFING

780 CMR 120.F101 GENERAL

120.F101.1 General. Buildings or structures and the walls enclosing habitable or occupiable rooms and spaces in which persons live, sleep or work, or in which feed, food or foodstuffs are stored, prepared, processed, served or sold, shall be constructed in accordance with the provisions of 780 CMR 120.F101.

120.F101.2 Foundation Wall Ventilation Openings. Foundation wall ventilator openings shall be covered for their height and width with perforated sheet metal plates no less than 0.070 inch (1.8 mm) thick, expanded sheet metal plates not less than 0.047 inch (1.2 mm) thick, cast iron grills or grating, extruded aluminum load-bearing vents or with hardware cloth of 0.035 inch (0.89 mm) wire or heavier. The openings therein shall not exceed ¼ inch (6.4 mm).

120.F101.3 Foundation and Exterior Wall Sealing. Annular spaces around pipes, electric cables, conduits, or other openings in the walls shall be protected against the passage of rodents by closing such openings with cement mortar, concrete masonry or noncorrosive metal.

120.F101.4 Doors. Doors on which metal protection has been applied shall be hinged so as to be free swinging. When closed, the maximum clearance between any door, door jambs and sills shall not be greater than ⅜ inch (9.5 mm).

120.F101.5 Windows and Other Openings. Windows and other openings for the purpose of light or ventilation located in exterior walls within two feet (610 mm) above the existing ground level immediately below such opening shall be covered for their entire height and width, including frame, with hardware cloth of at least 0.035 inch (0.89 mm) wire or heavier.

Note: For emergency escape windows, all screens and any security grid systems shall conform to the requirements of 780 CMR, 527 CMR (the State Fire Code) and the 105 CMR (State Sanitary Code) as applicable and such that emergency escape or fire department rescue efforts are not hindered.

120.F101.5.1 Rodent-accessible Openings. Windows and other openings for the purpose of light and ventilation in the exterior walls not covered in this chapter, accessible to rodents by way of exposed pipes, wires, conduits and other appurtenances, shall be covered with wire cloth of at least 0.035 inch (0.89 mm) wire. In lieu of wire cloth covering, said pipes, wires, conduits and

other appurtenances shall be blocked from rodent usage by installing solid sheet metal guards 0.024 inch (0.61 mm) thick or heavier. Guards shall be fitted around pipes, wires, conduits or other appurtenances. In addition, they shall be fastened securely to and shall extend perpendicularly from the exterior wall for a minimum distance of 12 inches (305 mm) beyond and on either side of pipes, wires, conduits or appurtenances.

120.F101.6 Pier and Wood Construction.

120.F101.6.1 Sill less than 12 Inches above Ground. Buildings not provided with a continuous foundation shall be provided with protection against rodents at grade by providing either an apron in accordance with 780 CMR 120.F101.6.1.1 or a floor slab in accordance with 780 CMR 120.F101.6.1.2.

120.F101.6.1.1 Apron. Where an apron is provided, the apron shall not be less than eight inches (203 mm) above, nor less than 24 inches (610 mm) below, grade. The apron shall not terminate below the lower edge of the siding material. The apron shall be constructed of an approved nondecayable, water-resistant ratproofing material of required strength and shall be installed around the entire perimeter of the building. Where constructed of masonry or concrete materials, the apron shall not be less than 4 inches (102 mm) in thickness.

120.F101.6.1.2 Grade Floors. Where continuous concrete grade floor slabs are provided, open spaces shall not be left between the slab and walls, and openings in the slab shall be protected.

120.F101.6.2 Sill at or above 12 Inches above Ground. Buildings not provided with a continuous foundation and which have sills 12 or more inches (305 mm) above the ground level shall be provide with protection against rodents at grade in accordance with any of the following:

1. 780 CMR 120.F101.6.1.1 or 120.F101.6.1.2;
2. By installing solid sheet metal collars at least 0.024 inch (0.6 mm) thick at the top of each pier or pile and around each pipe, cable, conduit, wire or other item which provides a continuous pathway from the ground to the floor; or
3. By encasing the pipes, cables, conduits or wires in an enclosure constructed in accordance with 780 CMR 120.F101.6.1.1.

780 CMR: STATE BOARD OF BUILDING REGULATIONS AND STANDARDS
THE MASSACHUSETTS STATE BUILDING CODE

NON-TEXT PAGE

780 CMR 120.G**FLOOD RESISTANT CONSTRUCTION
AND CONSTRUCTION IN COASTAL DUNES***(Note: 780 CMR 120.G is unique to Massachusetts)***780 CMR 120.G101 GENERAL**

120.G101.1 General: All buildings and structures erected in areas prone to flooding and/or coastal dunes shall be constructed and elevated as required by the provisions of 780 CMR 120.G.

780 CMR 120.G201 DEFINITIONS

120.G201.1 Definitions. The following words and terms shall, for the purposes of 780 CMR 120.G, and as used elsewhere in 780 CMR, have the meanings shown in 780 CMR 120.G201.

A-Zones: A Zones are synonymous with Flood-Hazard Zones.

Base Flood Elevation: The flood having a 1% chance of being equaled or exceeded in any given year and shall be used to define areas prone to flooding, and describe at a minimum, the depth or peak elevation of flooding.

Basement/Cellar: Any area of the building having its floor subgrade (below ground level) on all sides.

Breakaway Wall: A wall that is not part of the structural support of the building and intended, through its design and construction, to collapse under specific lateral loading forces, without causing damage to the elevated portion of the building or supporting foundation system.

Coastal Dune: Any natural hill, mound or ridge of sediment landward of a coastal beach deposited by wind action or storm overwash. Coastal Dune also means sediment deposited by artificial means and serving the purpose of storm damage prevention or flood control.

Coastal Wetland Resource Area: Any coastal wetland resource area subject to protection under M.G.L. c. 131, § 40 (the Wetlands Protection Act), and 310 CMR 10.21 through 10.35: *Coastal Wetlands*. Coastal Wetland Resource Areas include barrier beaches, coastal beaches, coastal dunes, rocky intertidal shores, tidal flats, land subject to 100 year coastal storm flowage, coastal banks, land containing shellfish, lands subject to tidal action, and lands under an estuary, salt pond or certain streams, ponds, rivers, lakes or creeks within the coastal zone that are anadromous/catadromous fish runs.

Conservation Commission: Body comprised of members lawfully appointed pursuant to M.G.L. c. 40, § 8C. It shall also mean a mayor or board of selectmen, where no conservation commission

has been established pursuant to M.G.L. c. 40, § 8C.

Determination of Applicability: A written finding by the issuing authority under M.G.L. c. 131, § 40 (the Wetlands Protection Act), as to whether a site or the work proposed therein is subject to jurisdiction under M.G.L. c. 131, § 40.

Elevation: The placement of a structure above flood level to minimize or prevent flood damages or to preserve the flood control and storm damage prevention functions of a coastal dune.

Failure of a Foundation: a foundation that is no longer supporting the building or foundation or is determined by the building official to be unsafe or incapable of continuing to support the building. For example, failure of a foundation occurs when a building or structure or portion thereof falls off the foundation or when the building official determines there is a risk that the building or structure may fall off the foundation.

Flood- Hazard Zones: Areas subject to a 1% or greater chance of flooding in any given year and that are not subject to wave heights in excess of three feet. (A ZONES).

Floodproofing: Any combination of structural and non-structural additions, changes or adjustments to structures which reduce or eliminate flood damage to new or substantially improved structures.

F.E.M.A.: Federal Emergency Management Agency.

Flood Insurance Rate Map: Flood insurance rate map (FIRM) means an official map of a community, which delineates both the special hazard zones and the risk premium zones applicable to the community.

High-hazard Zones (V Zones): Areas of tidal influence which have been determined to be subject to wave run heights in excess of three feet or subject to high-velocity wave run-up or wave-induced erosion (V Zones).

Highest Adjacent Grade: The highest natural elevation of the ground surface, prior to construction, adjoining the proposed foundation walls of a structure.

Impact Loads: Loads induced by the collision of solid objects on a structure carried by floodwater.

Interests Identified in M.G.L. c. 131, § 40 (the Wetlands Protection Act): Public or private ground water supply, flood control, storm damage prevention, prevention of pollution, protection of land containing shellfish, protection of fisheries, and protection of wildlife habitat.

Issuing Authority under M.G.L. c. 131, § 40 (the Wetlands Protection Act): a conservation commission, mayor, the selectmen or the Department of Environmental Protection.

Lateral Addition: an addition that expands the footprint of a building or structure including a manufactured home.

Lowest Floor: The lowest floor of the lowest enclosed area (including basement/cellar). An unfinished or flood resistant enclosure, usable solely for parking of vehicles, building access, or incidental storage in an area other than a basement/cellar with appropriate hydrostatic openings as required in 780 CMR 120.G501.4 is not considered a building's lowest floor.

Manufactured Home: A structure that is transportable in one or more sections, built on a permanent chassis, designed for use with or without a permanent foundation when attached to the required utilities, and constructed to the Federal Mobile Home Construction and Safety Standards and rules and regulations promulgated by the U.S. Department of Housing and Urban Development. The term also includes mobile homes, park trailers, travel trailers and similar transportable structures that are placed on a site for 180 days or longer. The term "manufactured home" does not include a "recreational vehicle".

Manufactured Housing: Manufactured Housing is synonymous with Manufactured Home.

Notification of Non-significance: A written finding by the issuing authority under M.G.L. c. 131, § 40 (the Wetlands Protection Act), that the area on which the proposed work is to be done or which the proposed work will alter is not significant to any of the interests identified in M.G.L. c. 131, § 40.

Order of Conditions: Written requirements by the issuing authority under M.G.L. c. 131, § 40 (the Wetlands Protection Act) establishing the manner in which work shall be done for work proposed within areas subject to jurisdiction under M.G.L. c. 131, § 40.

Order of Resource Area Delineation: Written findings by the issuing authority under M.G.L. c. 131, § 40 (the Wetlands Protection Act) identifying the boundaries of the area(s) subject to jurisdiction under M.G.L. c. 131, § 40.

Recreational Vehicle: A vehicle that is built on a single chassis 400 square feet or less when

measured at the largest horizontal projection, designed to be self-propelled or permanently towable by a light duty truck, and designed primarily not for use as a permanent dwelling, but as temporary living quarters for recreational, camping, travel or seasonal use. A recreational vehicle is ready for highway use, if it is on wheels or a jacking system, is attached to the site only by quick disconnect type utilities and security devices, and has no permanently attached additions.

Scouring: The erosion or washing away of slopes or soil by velocity waters.

Special Hazard Zones: An area having special flood, and/or flood-related erosion hazards and shown on Flood Hazard Boundary Map or FIRM as Zone A, AO, A1-30, AE, A99, AH, VO, V1-30, VE, V.

Start of Construction: The date the building permit was issued, provided the actual start of construction, repair, reconstruction, placement, or other improvement was within 180 days of the permit date. The actual start means the first placement of permanent construction of a structure on a site, such as the pouring of slab or footings, the installation of piles, the construction of columns, or any work beyond the stage of excavation or the placement of a manufactured home on a foundation.

Structure (this definition is intended utilized with this 780 CMR 120.G): A walled and roofed building, including a gas or liquid storage tank, that is principally above ground and affixed to a permanent site, as well as a manufactured home.

Substantial Damage: Damage of any origin sustained by a building or structure including a manufactured home whereby the cost of restoring the building or structure to its before damaged condition would equal or exceed 50% of the market value of the building or structure before the damage occurred.

Substantial Improvements: Substantial improvement means any reconstruction, rehabilitation, addition, repair or improvement of a structure, the cost of which equals or exceeds 50% of the market value of the structure before the "start of construction" of the improvement. This term includes structures which have incurred "Substantial damage", regardless of the actual repair work performed. Substantial improvement does not, however, include either:

1. any project for improvement of a structure to correct existing violations of state or local health, sanitary, or safety codes which have been identified by the local code enforcement official and which are the minimum necessary to assure safe living conditions or
2. any alteration of a "Historic structure", provided that the alteration will not preclude

the structure's continued designation as a "historic structure."

Note 1: The following items can be excluded from the cost of improvement or repair: plans, specifications, survey, permits, and other items which are separate from or incidental to the repair of the damaged or improved building, *i.e.* debris removal/cartage.

Note 2: The latest Assessors' structure value may be used, provided that the Assessors certify that said value is based on 100% valuation, less depreciation.

Substantial Repair of a Foundation: Work to repair and/or replace a foundation that results in the repair or replacement of the portion of the foundation walls with a perimeter along the base of the foundation that equals or exceeds 50% of the perimeter of the base of the entire foundation measured in linear feet. The term "substantial repair of a foundation" also includes a building or structure including a manufactured home that has incurred a failure of a foundation regardless of the actual work done to repair or replace the foundation.

V Zones: V Zones are synonymous with High-Hazard Zones.

Variance: A grant of relief by a community and the Commonwealth, via the Boards of Appeal, from the terms of the Floodplain Management Regulations.

Venting: A system designed to allow flood waters to enter an enclosure, usually the interior of foundations walls, so that the rising water does not create a dangerous differential in hydrostatic pressure; usually achieved through openings in the walls. Vents may be installed in garage doors to satisfy this requirement, provided such vents are installed consistent with 780 CMR 120.G. The necessity of human intervention, such as opening garage doors, does not satisfy this requirement.

780 CMR 120.G301 BASE FLOOD ELEVATION

120.G301.1 Base Flood Elevation. The base flood elevation shall be used to define areas prone to flooding, and shall describe, at a minimum, the depth or peak elevation of flooding (including wave height) which has a 1% (100-year flood) or greater chance of occurring in any given year

The 100-year flood elevation shall be determined as follows:

1. In A1-30, AH, AE, V1-30 and VE, the Base Flood Elevation is provided on the community's Flood Insurance Study and the Flood Insurance Rate Map (FIRM).
2. In AO zones, add the depth provided on the Flood Insurance Rate Map to the highest adjacent

grade. If no depth is provided, add at least two feet to the highest adjacent grade.

3. In A, A99 and V zones, the building official, design professional, or surveyor shall obtain, review and reasonably utilize any Base Flood Elevation Data available from a federal, state or other reliable sources.

780 CMR 120.G401 HAZARD ZONES

120.G401.1 Hazard Zones. Areas which have been determined to have a 1% or greater chance of flooding in any given year shall be classified as either flood-hazard zones (A Zones) or high-hazard zones (V Zones) in accordance with 780 CMR 120.G501 and 120.G601.

780 CMR 120.G501 FLOOD HAZARD ZONES

120.G501.1 Construction in Flood-hazard zones (A Zones). All areas which have a 1% or greater chance of flooding in any given year but are not subject to wave heights in excess of three feet shall be designated as flood-hazard zones. Flood-hazard zones shall include all areas shown as A Zones on the most recent Flood Hazard Boundary Map or FIRM. All buildings and structures as defined in 780 CMR 120.G201 including new or replacement manufactured homes erected or substantially improved in flood-hazard zones shall be designed and constructed in accordance with 780 CMR 120.G501.

Plans for the construction or substantial improvement of a building or structure, including a new or replacement manufactured home, in a flood-hazard zone shall be prepared by a qualified registered professional engineer or architect to ensure the compliance with 780 CMR 120.G501.

Exception: If a substantial improvement consists exclusively of a lateral addition that does not rely on the support of the existing structure, only the lateral addition must be erected in accordance with the applicable provisions of 780 CMR 120.G501. In that event, the existing structure is not required to come into compliance with 780 CMR 120.G501.

Note: If located in a coastal dune that is significant to flood control and/or storm damage prevention, a building or structure, including a new or replacement manufactured home, in a flood-hazard zone shall be designed and constructed in accordance with the applicable provisions of 780 CMR 120.G701, and 120.G801 as well as 780 CMR 120.G501.

120.G501.2 Elevation in a Flood-hazard Zone. Except as otherwise provided in 120.G501, all buildings or structures, including new or replacement manufactured homes, erected or substantially improved within a flood-hazard zone shall be elevated so that the lowest floor is located at or above the base flood elevation. All basement/

cellar floor surfaces shall be located at or above the base flood elevations.

Exception: Floors of occupancy in any use group, other than use group R, below the base flood elevation shall conform to 780 CMR 120.G501.5.2. Floors of occupancies in any use group which are utilized solely for structure means of egress, incidental storage garages and parking, and which are located below the base flood elevation, shall conform to 780 CMR 120.G501.4.

120.G501.3 Anchorage in a Flood-hazard Zone. The structural systems of all buildings or structures, including new or replacement manufactured homes, shall be designed, connected and anchored to resist flotation, collapse or permanent lateral movement due to structural loads and stresses from flooding equal to the base flood elevation and shall be designed in accordance with 780 CMR 1615.2 and 1615.3.

120.G501.4 Enclosures below Base Flood Elevation in a Flood-hazard Zone. Enclosed spaces below the base flood elevation shall not be used for human occupancy with the exception of structural means of egress, entrance foyers, stairways and incidental storage. Fully enclosed spaces shall be designed to equalize automatically hydrostatic forces on exterior walls by allowing for the entry and exit of floodwaters. Designs for meeting this requirement shall either be certified by a registered design professional in accordance with 780 CMR 120.G501.11 through 120.G501.13 or conform to the following minimum criterion: a minimum of two openings having a total net area of not less than one square inch (645 mm²) for every one square foot (0.1 m²) of enclosed area subject to flooding shall be provided. The bottom of all openings shall not be higher than 12 inches (305 mm) above grade immediately adjacent to the location of the opening. Openings shall not be equipped with screens, louvers, valves or other coverings or devices unless such devices permit the automatic entry and discharge of floodwaters.

120.G501.5 Water-resistant Construction in a Flood-hazard Zone. Occupancies in any use group other than Use Group R may, in lieu of meeting the elevation provisions of 780 CMR 120.G501.2 be erected with floors usable for human occupancy below the base flood elevation provided that the following conditions are met:

1. All space below the base flood elevation shall be constructed with walls and floors that are substantially impermeable to the passage of water.
2. All structural components subject to hydrostatic and hydrodynamic loads and stresses during the occurrence of flooding to the base flood elevation shall be capable of resisting such forces, including the effects of buoyancy.
3. All openings below the base flood elevation

shall be provided with water-tight closures and shall have adequate structural capacity to support all flood loads acting upon the closure surfaces.

4. All floor and wall penetrations for plumbing, mechanical and electrical systems shall be made water tight to prevent floodwater seepage through spaces between the penetration and wall construction materials. Sanitary sewer and storm drainage systems that have openings below the base flood elevation shall be provided with shutoff valves or closure devices to prevent backwater flow during conditions of flooding.

120.G501.6 Repair or Replacement of Existing Foundations in a Flood-hazard Zone. Existing foundations in a flood-hazard zone may be repaired without further compliance with 780 CMR 120.G501, unless the work replaces the foundation in total, replaces the foundation so as to constitute new construction or constitutes a substantial repair of a foundation as defined in 780 CMR 120.G201. In such events, the foundation shall be brought into compliance with the applicable provisions of 780 CMR 120.G501.

See Note 780 CMR 120.G501.1.

120.G501.7 Protection of Mechanical and Electrical Systems in a Flood-hazard Zone. New and replacement electrical, heating, ventilating, air conditioning and other service equipment in a flood-hazard zone shall either be placed above the base flood elevation or protected so as to prevent water from entering or accumulating within the system components during floods up to the base flood elevation in accordance with the mechanical code listed in 780 CMR 100.0. Installation of electrical wiring and outlets, switches, junction boxes and panels below the base flood elevation shall conform to the provisions of 527 CMR 12.00 listed in 780 CMR 100.0 for location of such items in wet locations. Duct insulation subject to water damage shall not be installed below the base flood elevation.

120.G501.8 Construction Materials, Methods, and Practices in a Flood-hazard Zone. All buildings or structures, including new or replacement manufactured homes, erected in a flood-hazard zone shall be constructed with materials resistant to flood damage and be constructed by methods and practices that minimize flood damage. Construction materials shall be resistant to water damage in accordance with the provisions of 780 CMR 1808.0, 1810.2, 1813.4, 2307.2, 2309.1, 2311.4, 2311.6, and 2503.4.

120.G501.9 Recreational Vehicles in a Flood-hazard Zone. All recreational vehicles placed in a flood-hazard zone and that are not fully licensed and ready for highway use or that are to be placed on a site for more than 180 consecutive days shall comply with the provisions of 780 CMR 120.G501 applicable to buildings or structures, including new or replacement manufactured homes.

120.G501.10 Alterations, Renovation and Repairs in a Flood-hazard Zone. Alterations, renovations and repairs to existing buildings and structures including new or replacement manufactured homes located in a flood-hazard zone shall comply with applicable provisions of 780 CMR. Compliance with 780 CMR 120.G501 is required whenever such alteration, renovation or repair constitutes a substantial repair of a foundation as defined in 780 CMR 120.G201, repair or replacement of a foundation that requires compliance with 780 CMR 120.G501, or a substantial improvement as defined in 780 CMR 120.G201.

120.G501.11 Certifications and Plans for Construction in a Flood-hazard Zone. Certifications and plans shall be submitted in accordance with 780 CMR 120.G501.12 and 120.G501.13 for a substantial repair of a foundation as defined in 780 CMR 120.G201, repair or replacement of a foundation that requires compliance with 780 CMR 120.G501, a substantial improvement as defined in 780 CMR 120.G201, or a building or structure as defined in 780 CMR 120.G201, including a new or replacement manufactured home.

120.G501.12 As-built Elevation Certification for Construction in a Flood-hazard Zone. For all substantial repairs of a foundation as defined in 780 CMR 120.G201, all repairs or replacement of a foundation that trigger the requirement to comply with 780 CMR 120.G501, all substantial improvements as defined in 780 CMR 120.G201, and all buildings or structures including new and replacement manufactured homes, a licensed land surveyor or registered design professional shall certify the actual elevation in relation to the base flood elevation of the lowest floor required to be elevated by the provisions of 780 CMR 120.G501.2. The certification required shall be submitted to the building official after the construction of the foundation is complete and before the commencement of any other work on the building or structure or, if there is no other work, the occupancy of the building or structure.

120.G501.13 Documentation -Water Resistant Construction in a Flood-hazard Zone. Where buildings or structures including new or replacement manufactured homes are to be constructed in accordance with 780 CMR 120.G501.5, the building official shall require that a registered design professional provide construction documents showing proposed details of floor, wall, foundation support components, loading computations, and other essential technical data used in meeting the conditions of 780 CMR 120.G501.5. The construction documents shall be accompanied by a statement bearing the signature of the registered design professional indicating that the design and proposed methods of construction are in accordance

with applicable provisions of 780 CMR 120.G501.5.

780 CMR 120.G601 HIGH HAZARD ZONES

120.G601.1. Construction in High-hazard Zones (V Zones). Areas of tidal influence which have been determined to be subject to wave heights in excess of three feet (914 mm) or subject to high-velocity wave run-up or wave-induced erosion shall be classified as high-hazard zones. High-hazard zones shall include all areas shown as V Zones on the most recent Flood Hazard Boundary Map or FIRM. All buildings or structures as defined in 780 CMR 120.G201, including new or replacement manufactured homes, erected or substantially improved in a high-hazard zone shall be designed and constructed in accordance with 780 CMR 120.G601. All lateral additions of a building or structure in a high-hazard zone shall also be designed and constructed in accordance with 780 CMR 120.G601 whether or not the lateral addition constitutes a substantial improvement. Plans for a building, structure, substantial improvement, or lateral addition in a high-hazard zone shall be prepared by a registered professional engineer or architect to ensure compliance with 780 CMR 120.G601.

Note: If located in a coastal dune significant to flood control and/or storm damage prevention and a high-hazard zone, a building, structure, including a new or replacement manufactured home, a lateral addition, and a substantial improvement of a building or structure that has suffered substantial damage as a result of flooding or storms shall be designed and constructed in accordance with 780 CMR 120.G701 and 120.G801 as well as 120.G601.

120.G601.1.1 High-hazard Zone Construction Documents Requirements. Where buildings or structures are to be constructed in accordance with 780 CMR 120.G601, the building official shall require that a registered design professional provide construction documents showing proposed details of foundation support and connection components which are used in meeting the requirements of 780 CMR 120.G601.4. Where solid walls or partitions are proposed that are less than two feet above the base flood elevations, wall, framing and connection details of such walls shall be provided, including loading computations for the wall and foundation system used in meeting the conditions of 780 CMR 120.G601.3. The construction documents shall be accompanied by a statement bearing the signature of the registered design professional indicating that the design and proposed methods of construction are in accordance with all applicable provisions of 780 CMR 120.G601.

120.G601.2 Elevation in a High-hazard Zone. All buildings or structures including new and replacement manufactured homes erected or substantially improved within a high-hazard zone shall be elevated so that the bottom of the lowest horizontal structural member supporting the lowest floor, with the exception of mat or raft foundations, piling, pile caps, columns, grade beams and bracing, is located at an elevation that is at least two feet above the base flood elevation. All lateral additions erected in a high-hazard zone shall also be elevated so that the lowest portion of all structural members supporting the lowest floor of the lateral addition with the exception of mat or raft foundations, pilings, pile caps, columns, grade beams and bracing shall also be located at an elevation that is at least two feet above the base flood elevation.

120.G601.3 Enclosures below Base Flood Elevation in a High-hazard Zone. All spaces that are less than two feet above the base flood elevation in a high-hazard zone shall not be used for human occupancy and shall be free of obstruction except as permitted in 780 CMR 120.G601.3:

1. Mat or raft foundations, piling, pile caps, bracing, grade beams and columns which provide structural support for the building.
2. Entrances and exits which are necessary for required ingress and means of egress.
3. Incidental storage of portable or mobile items readily moved in the event of a storm.
4. Walls and partitions are permitted to enclose all or part of the space below the elevated floor provided that such walls and partitions are not part of the structural support of the building and are constructed with insect screening, open wood lattice, or nonsupporting walls designed to break away or collapse without causing collapse, displacement or other structural damage to the elevated portion of the building or supporting foundation system due to the effect of wind loads as specified in 780 CMR 1611.0 and water loads as specified in 780 CMR 1615.0 acting simultaneously. Any such nonsupporting solid wall shall be certified as specified in 780 CMR 120.G601.10 and 120.G601.11.

120.G601.4 Foundations in a High-hazard Zone. All buildings or structures, including new and replacement manufactured homes, erected or substantially improved in high-hazard zones shall be supported on pilings or columns and shall be adequately anchored to such pilings or columns. All lateral additions in high-hazard zones shall also be supported on pilings or columns and shall be adequately anchored to such pilings or columns. The piling shall have adequate soil penetrations to resist the combined wave and wind loads (lateral and uplift) to which such piles are likely to be subjected during a flood to the base flood elevation. Pile embedment shall include consideration of decreased resistance capacity caused by scour of soil strata

surrounding the piling. Pile system design and installation shall also be made in accordance with the provisions of 780 CMR 1816.0 and 1817.0. Mat or raft foundations which support columns shall not be permitted where soil investigations required in accordance with 780 CMR 1802.1 indicate that soil material under the mat or raft is subject to scour or erosion from wave-velocity flow conditions.

120.G601.5 Repair or Replacement of Existing Foundations in a High-hazard Zone. Existing foundations may be repaired in a high-hazard zone without further compliance with 780 CMR 120.G, unless the work replaces the foundation in total, replaces the foundation so as to constitute new construction, or constitutes a substantial repair of a foundation as defined in 780 CMR 120.G201. In such events, the foundation shall be brought into compliance with the applicable provisions of 780 CMR 120.G601.

See Note to 780 CMR 120.G601.1.

120.G601.6. Protection of Mechanical and Electrical Systems in a High-hazard Zone. New and replacement electrical equipment and heating, ventilating, air conditioning and other service equipment in a high-hazard zone shall be either placed at least two feet above the base flood elevation or protected so as to prevent water from entering or accumulating within the system components during floods in accordance with the mechanical code listed in 780 CMR 100.0. Installation of electrical wiring and outlets, switches, junction boxes and panels that are less than two feet above the base flood elevation shall conform to the provisions of 527 CMR 12.00 listed in 780 CMR 100.0 for location of such items in wet locations. Duct insulation subject to water damage shall be installed at least two feet above the base flood elevation.

120.G601.7. Construction Materials, Methods and Practices in a High-hazard Zone. All buildings or structures including new or replacement manufactured homes erected in high-hazard zones (V Zones) shall be constructed with materials resistant to flood damage and be constructed by methods and practices that minimize flood damage. Construction materials shall be resistant to water damage in accordance with the provisions of 780 CMR 1808.0, 1810.2, 1813.4, 2307.2, 2309.1, 2311.4, 2311.6 and 2503.4.

120.G601.8 Recreational Vehicles in a High-hazard Zone: Recreational vehicles placed in a high-hazard zone and that are not fully licensed and ready for highway use or that are to be placed on a site for more than 180 consecutive days shall comply with the provisions of 780 CMR 120.G601 applicable to buildings or structures including new or replacement manufactured homes.

120.G601.9 Alterations, Renovations and Repairs in a High-hazard Zone. Alterations, renovations and repairs to existing buildings, including manufactured homes, located in a high-hazard zone shall comply with all applicable provisions of 780 CMR. Compliance with 780 CMR 120.G. is required whenever such alteration, renovation or repair constitutes substantial repair of a foundation as defined in 780 CMR 120.G201, the repair or replacement of a foundation that requires compliance with 780 CMR 120.G601, as set forth in 780 CMR 120.G601.5, a substantial improvement as defined in 780 CMR 120.G201, or a lateral addition as defined in 780 CMR 120.G201.

120.G601.10 Certifications and Plans for Construction in a High-hazard Zone. Certifications and plans shall be submitted in accordance with 780 CMR 120.G601.10 and 120.G601.11 for a substantial repair of a foundation as defined in 780 CMR 120.G201, a repair or replacement of a foundation that requires compliance with 780 CMR 120.G601, a substantial improvement as defined in 780 CMR 120.G201, a lateral addition as defined in 780 CMR 120.G201, or a building, or structure, including a new and replacement manufactured home.

120.G601.11 As-built Elevation Certifications for Construction in a High-hazard Zone. For all substantial repairs of a foundation as defined 780 CMR 120.G201, all repairs or replacements of a foundation that trigger the requirement to comply with 780 CMR 120.G601, all substantial improvements as defined in 780 CMR 120.G201, all lateral additions as defined in 780 CMR 120.G201, and all buildings and structures, including new and replacement manufactured homes, a licensed land surveyor or registered design professional shall certify the actual elevation (in relation to the base flood elevation) of the lowest horizontal structural member required to be elevated by the provisions of 780 CMR 120.G601.2. The certification required herein shall be submitted to the building official after the construction of the foundation is complete and before the commencement of any other work on the building or structure or, if there is no other work, the occupancy of the building or structure.

120.G701 COASTAL DUNES

120.G701.1 Determination of Coastal Dunes. To reduce flood damage, ensure the structural integrity of buildings or structures including manufactured homes, located in coastal dunes, to protect the public safety and to eliminate certain conflicts between the coastal dune performance standards set forth in the Wetlands Protection Act Regulations, 310 CMR 10.28, and this Code, 780 CMR 120.G701 and 120.G801 establish requirements for design and construction in coastal dunes significant to the interests of flood control and/or storm damage prevention identified in 310 CMR 10.28: *Coastal*

Dunes.

To determine whether a proposed building or structure, including a manufactured home, a lateral addition, work on a foundation that under 780 CMR 120.G801.6 requires compliance with 780 CMR 120.G801, or substantial improvement to a building or structure that has incurred substantial damage as a result of flooding and/or storms is located within an area that is a coastal dune significant to the interests of flood control and/or storm damage prevention, the building official shall require the submission of certain construction documents in accordance with 780 CMR 120.G701.1.

120.G701.1.1 Submission of Construction Documents for Proposed Work in a Coastal Wetland Resource Area. For all buildings or structures, including new or replacement manufactured homes, all lateral additions, all work on a foundation that under 780 CMR 120.G801.6 requires compliance with 120.G801, and all substantial improvements of a building or structure that has incurred substantial damage as a result of flooding and/or storms proposed on a parcel of land that is located wholly or partially within a coastal wetland resource area shown on the map entitled "Map of Coastal Wetland Resources For Building Officials", the building official shall require submission of one of the construction documents specified in 780 CMR 120.G701.1.1(a) through (d) along with a notarized statement by the applicant that the Order, Determination or Notice is in effect and is not the subject of any administrative appeals before the Department of Environmental Protection or the Division of Administrative Law Appeals. No building permit shall issue unless and until a construction document that conforms to the requirements of 780 CMR 120.G701.1 including 120.G701.1(a) through (d) below is submitted.

(a) An Order of Conditions establishing the boundaries of all coastal wetland resource areas in a plan referenced in and accompanying the Order. The Order together with the plan referenced therein shall identify the boundaries of all coastal wetland resource areas including coastal dunes and determine whether the coastal wetland resource areas are significant to any of the interests identified in M.G.L. c. 131, § 40 (the Wetlands Protection Act) including the interests of flood control and storm damage prevention. If the Order of Condition and the plan referenced therein indicate that the proposed construction work is located within a coastal dune that is significant to the interests of flood control and/or storm damage prevention, the Order of Conditions must allow the proposed construction.

(b) An Order of Resource Area Delineation stating that the proposed construction work is outside the boundaries of all coastal wetland

resource areas as shown on a plan referenced in and accompanying the Order.

(c) A Determination of Applicability stating that the proposed construction work is outside the boundaries of all coastal wetland resource areas as shown on a plan referenced in and accompanying the Determination or will not fill, dredge or alter a coastal wetland resource area.

(d) A Notice of Non-significance evidencing that the proposed construction work is within a coastal wetland resource area as shown on a plan referenced in and accompanying the Notice and stating that the coastal wetland resource area is not significant to any of the interests identified in M.G.L. c. 131, § 40 (the Wetlands Protection Act).

120.G801 CONSTRUCTION IN COASTAL DUNES

120.G801.1 Requirements for Design and Construction in Coastal Dunes. All buildings and structures including manufactured homes, all lateral additions, all substantial improvements to a building or structure that has incurred substantial damage as a result of flooding and/or storms, and all work on a foundation that under 780 CMR 120.G801.6 requires compliance with 780 CMR 120.G801, that are proposed within an area that is a coastal dune significant to the interests of storm damage prevention and/or flood control shall comply with the provisions of 780 CMR 120.G801 including 120.G801.1 through 120.G801.11. The determination of whether such construction work is proposed to be located within an area that is a coastal dune significant to the interests of storm damage prevention and/or flood control shall be based solely on the construction documents submitted to the building official in accordance with 780 CMR 120.G701 including 120.G701.1.1(a) through (d). If the proposed construction work is also located in a flood-hazard zone or a high-hazard zone, the construction work shall also comply with applicable provisions of 780 CMR 120.G501 or 120.G601, as applicable.

Note 1: A lateral addition proposed to be constructed within a coastal dune that is significant to the interests of flood control and/or storm damage prevention shall be constructed in accordance with 780 CMR 120.G801.1 through 120.G801.11 whether or not the lateral addition is a substantial improvement as defined in 780 CMR 120.G201.

Note 2: A substantial improvement to a building or structure including a manufactured home, that is located in a coastal dune that is significant to the interests of flood control and/or storm damage prevention and that has not incurred substantial damage as a result of flooding or storms does not trigger the requirement that the existing building

or structure be brought into compliance with 780 CMR 120.G801.1 through 120.G801.11.

Note 3: If located in a flood hazard-zone or a high hazard zone, a substantial improvement to a building or structure, including a manufactured home, in a coastal dune that is significant to flood control and/or storm damage prevention must comply with all applicable provisions of 780 CMR 120.G501 or 120.G601.

120.G801.2 Plans for Construction in a Coastal Dune. All plans for the construction of a building or structure including a new or replacement manufactured home and all plans for a lateral addition as defined in 780 CMR 120.G201, a substantial improvement of a building or structure that has incurred substantial damage as a result of flooding and/or storms, work on a foundation that under 780 CMR 120.G801.6 requires compliance with 780 CMR 120.G as applicable, proposed within an area that is a coastal dune significant to the interests of flood control and/or storm damage prevention shall be prepared by a registered professional engineer or architect to ensure compliance with 120.G801.3 through 120.G8.11.

120.G801.3 Foundation Types in a Coastal Dune. All buildings, structures, or lateral additions, and substantial improvements to a building or structure that has incurred substantial damage as a result of storms and/or flooding that are located in a coastal dune significant to the interests of flood control and/or storm damage prevention shall be supported on open pilings without footings to allow the lateral movement of the dune and shall be adequately anchored to such pilings. The pilings shall have adequate soil penetration to resist the combined wave and wind loads (lateral and uplift) to which such piles are likely to be subjected during storm events. Pile embedment shall include consideration of decreased resistance capacity caused by scour of soil strata surrounding the piling. Pile system design and construction shall be made in accordance with the provisions of 780 CMR 1816.0 and 1817.0.

Exception: Where surface or subsurface conditions consist of nonerodible soil that prevents the use of pile foundations, spread footing or mat foundations may be permitted provided they are anchored to prevent sliding, uplift or overturning to nonerodible soil with sufficient strength to withstand forces from the combinations of load.

Note: An Order of Conditions is required for the construction of a new foundation in a coastal dune that is significant to the interests of flood control or storm damage prevention. An Order of Conditions is also required for work on a foundation that under 780 CMR 120.G8.6 requires compliance with 780 CMR 120.G801. To allow the lateral movement of the dune, the Order of Conditions may impose

additional requirements or restrictions on the use of certain foundation types based on site-specific factors. All foundations in such a coastal dune must also be designed and constructed in accordance with the Order of Conditions.

120.G801.4 Elevation in a Coastal Dune. Within a coastal dune that is significant to the interests of flood control and/or storm damage prevention, all buildings or structures including new and replacement manufactured homes, all lateral additions as defined in 780 CMR 120.G201, and all substantial improvements of a building or structure that has incurred substantial damage as a result of flooding or storms shall be erected so that the bottom of the lowest horizontal structural member of the lowest floor with the exception of pilings or pile caps is located at the elevation required by the Order of Conditions.

Note: Orders of Conditions issued by a Conservation Commission may be appealed to the Massachusetts Department of Environmental Protection and the Division of Administrative Law Appeals by following the procedures set forth in 310 CMR 10.05(7).

120.G801.5 Recreational Vehicles in a Coastal Dune. Recreational vehicles placed in a coastal dune that is significant to the interests of flood control and/or storm damage prevention and that either are not fully licensed and ready for highway use or placed on the coastal dune for more than 180 consecutive days shall be designed and constructed in accordance with the requirements of 780 CMR 120.G801.1 through 801.11 applicable to buildings or structures including new or replacement manufactured homes.

120.G801.6 Repair or Replacement of Existing Foundations in a Coastal Dune. Except as otherwise provided herein, existing foundations in a coastal dune significant to the interests of flood control and/or storm damage prevention may be repaired without further compliance with 780 CMR 120.G, as applicable. Existing foundation systems in a coastal dune significant to the interests of flood control and/or storm damage prevention, which are replaced in total, which are replaced so as to constitute new construction, or any substantial repair of a foundation as defined in 780 CMR 120.G201 shall trigger the requirement that the foundation be brought into compliance with the applicable provisions of 780 CMR 120.G801 including 780 CMR 120.G801.3 and 120.G801.4.

120.G801.7 Substantial Improvement of a Building or Structure, Including a Manufactured Home, That Is Located in a Coastal Dune and Has Suffered Substantial Damage. All substantial improvements to a building or structure including a manufactured home that is located in a coastal dune that is significant to flood control and/or storm

damage prevention, and that has incurred substantial damage as a result of flooding or storms shall be subject to the requirements in 780 CMR 120.G701 and 780 CMR 120.G801 applicable to buildings or structures including without limitation the elevation and foundation type requirements of 780 CMR 120.G801.3 and 120.G801.4.

120.G801.8 Protection of Mechanical and Electrical Equipment in a Coastal Dune. New and replacement electrical equipment, heating, ventilating, air conditioning and other service equipment in a coastal dune that is significant to the interests of flood control and/or storm damage prevention shall be placed at the elevation required by the Order of Conditions.

120.G801.9 Certifications and Plans for Construction in a Coastal Dune. Certifications and plans in accordance with 780 CMR 120.G801.10 and 120.G801.11 shall be submitted for the following construction work in a coastal dune significant to the interests of flood control and/or storm damage prevention: all work on a foundation that under 780 CMR 120.G801.6 requires compliance with 780 CMR 120.G801, all lateral additions as defined in 780 CMR 120.G201, all buildings or structures, including new and replacement manufactured homes, and all substantial improvements of a building or structure that has incurred substantial damage as a result of flooding and/or storms.

120.G801.10 As-built Elevation Certification for Construction in a Coastal Dune. After the construction of the foundation is complete and before the commencement of any other work on the building or structure including a new or replacement manufactured home, or if there is no other work, the occupancy of the structure, a licensed land surveyor or registered design professional shall submit certification to the building official that the actual elevation of the lowest horizontal structural member in relation to the elevation of the dune prior to the start of construction meets or exceeds the requirements of 780 CMR 120.G801.4.

120.G801.11 Coastal Dune Construction Documents. The building official shall require that the registered design professional provide construction documents showing details of foundation support and components, loading computations and other essential data demonstrating compliance with the requirements of 780 CMR 120.G801 including 120.G801.3 and 120.G801.4 for the following construction work in a coastal dune significant to the interests of flood control and/or storm damage prevention: all work on a foundation that under 780 CMR 120.G801.6 requires compliance with 780 CMR 120.G801, all lateral additions as defined in 780 CMR 120.G201, all buildings or structures as defined in 780 CMR 120.G201, including new and replacement

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manufactured homes, and all substantial improvements of a building or structure that has incurred substantial damage as a result of flooding or storms. The construction documents shall be accompanied by a statement bearing the signature of

the registered design professional indicating that the design and proposed methods of construction are in accordance with applicable provisions of 780 CMR 120.G801 including 120.G801.3 through 120.G8

780 CMR 120.H

SIGNS

780 CMR 120.H101 GENERAL

120.H101.1 General. A sign shall not be erected in a manner that would confuse or obstruct the view of or interfere with exit signs required by Chapter 10 or with official traffic signs, signals or devices. Signs and sign support structures, together with their supports, braces, guys and anchors, shall be kept in repair and in proper state of preservation. The display surfaces of signs shall be kept neatly painted or posted at all times.

120.H101.2 Signs Exempt from Building Permits. The following signs are exempt from the requirements to obtain a permit before erection:

1. *Paint-only* nonilluminated signs.
2. Temporary signs announcing the sale or rent of property.
3. Signs erected by transportation authorities.
4. Projecting signs not exceeding 2.5 square feet (0.23 m²).
5. The changing of moveable parts of an approved sign that is designed for such changes, or the repainting or repositioning of display matter shall not be deemed an alteration.

780 CMR 120.H102 DEFINITIONS

120.H102.1 General. Unless otherwise expressly stated, the following words and terms shall, for the purposes of this appendix, have the meanings shown in 780 CMR 120.H102. Refer to 780 CMR 2.00 for general definitions.

COMBINATION SIGN. A sign incorporating any combination of the features of pole, projecting and roof signs.

DISPLAY SIGN. The area made available by the sign structure for the purpose of displaying the advertising message.

ELECTRIC SIGN. A sign containing electrical wiring, but not including signs illuminated by an exterior light source.

GROUND SIGN. A billboard or similar type of sign which is supported by one or more uprights, poles or braces in or upon the ground other than a combination sign or pole sign, as defined by 780 CMR.

POLE SIGN. A sign wholly supported by a sign structure in the ground.

PORTABLE DISPLAY SURFACE. A display surface temporarily fixed to a standardized advertising structure which is regularly moved from structure to structure at periodic intervals.

PROJECTING SIGN. A sign other than a wall sign, which projects from and is supported by a wall of a building or structure.

ROOF SIGN. A sign erected upon or above a roof or parapet of a building or structure.

SIGN. Any letter, figure, character, mark, plane, point, marquee sign, design, poster, pictorial, picture, stroke, stripe, line, trademark, reading matter or illuminated service, which shall be constructed, placed, attached, painted, erected, fastened or manufactured in any manner whatsoever, so that the same shall be used for the attraction of the public to any place, subject, person, firm, corporation, public performance, article, machine or merchandise, whatsoever, which is displayed in any manner outdoors. Every sign shall be classified and conform to the requirements of that classification as set forth in 780 CMR 120.H.

SIGN STRUCTURE. Any structure which supports or is capable of supporting a sign as defined in 780 CMR. A sign structure is permitted to be a single pole and is not required to be an integral part of the building.

WALL SIGN. Any sign attached to or erected against the wall of a building or structure, with the exposed face of the sign in a plane parallel to the plane of said wall.

780 CMR 120.H103 LOCATION

120.H103.1 Location Restrictions. Signs shall not be erected, constructed or maintained so as to obstruct any fire escape or any window or door or opening used as a means of egress or so as to prevent free passage from one part of a roof to any other part thereof. A sign shall not be attached in any form, shape or manner to a fire escape, nor be placed in such manner as to interfere with any opening required for ventilation.

A sign shall not be located in violation of local zoning requirements.

780 CMR 120.H104 IDENTIFICATION

120.H104.1 Identification. Every outdoor advertising display sign hereafter erected, constructed or maintained, for which a permit is required shall be plainly marked with the name of the person, firm or corporation erecting and maintaining such sign and shall have affixed on the front thereof the permit number issued for said sign or other method of identification approved by the building official.

780 CMR 120.H105 DESIGN AND CONSTRUCTION

120.H105.1 General Requirements. Signs shall be designed and constructed to comply with the provisions of 780 CMR for use of materials, loads and stresses.

120.H105.2 Permits, Drawings and Specifications. Where a permit is required, as provided in 780 CMR 1.00, construction documents shall be required. These documents shall show the dimensions, material and required details of construction, including loads, stresses and anchors.

120.H105.3 Wind Load. Signs shall be designed and constructed to withstand wind pressure as provided for in 780 CMR 16.00.

120.H105.4 Seismic Load. Signs designed to withstand wind pressures shall be considered capable of withstanding earthquake loads, except as provided for in 780 CMR 16.00.

120.H105.5 Working Stresses. In outdoor advertising display signs, the allowable working stresses shall conform to the requirements of 780 CMR 16.00. The working stresses of wire rope and its fastenings shall not exceed 25% of the ultimate strength of the rope or fasteners.

Exceptions:

1. The allowable working stresses for steel and wood shall be in accordance with the provisions of 780 CMR 22.00 and 23.00.
2. The working strength of chains, cables, guys or steel rods shall not exceed one-fifth of the ultimate strength of such chains, cables, guys or steel.

120.H105.6 Attachment. Signs attached to masonry, concrete or steel shall be safely and securely fastened by means of metal anchors, bolts or approved expansion screws of sufficient size and anchorage to safely support the loads applied.

780 CMR 120.H106 ELECTRICAL

120.H106.1 Illumination. A sign shall not be illuminated by other than electrical means, and electrical devices and wiring shall be installed in accordance with the requirements of 527 CMR 12.00: *Massachusetts Electrical Code*.

120.H106.1.1 Internally Illuminated Signs. Except as provided for in 780 CMR 402.14 and 2611, where internally illuminated signs have sign facings of wood or approved plastic, the area of such facing section shall not be more than 120 square feet (11.16 m²) and the wiring for electric lighting shall be entirely enclosed in the sign cabinet with a clearance of not less than two inches (51 mm) from the facing material. The dimensional limitation of 120 square feet (11.16 m²) shall not apply to sign facing sections made from flame-resistant-coated fabric (ordinarily

known as "flexible sign face plastic") that weighs less than 20 ounces per square yard (678 g/m²) and which, when tested in accordance with NFPA 701, meets the requirements of both the small-scale test and the large-scale test, or which, when tested in accordance with an approved test method, exhibits an average burn time for ten specimens of two seconds or less and a burning extent of 15 centimeters or less.

120.H106.2 Electrical Service. Signs that require electrical service shall comply with 527 CMR 12.00: *Massachusetts Electrical Code*.

780 CMR 120.H107 COMBUSTIBLE MATERIALS

120.H107.1 Use of Combustibles. Wood, approved plastic or plastic veneer panels as provided for in 780 CMR 26.00, or other materials of combustible characteristics similar to wood, used for moldings, cappings, nailing blocks, letters and latticing, shall comply with 780 CMR 120.H109.1, and shall not be used for other ornamental features of signs, unless approved.

120.H107.1.1 Plastic Materials. Notwithstanding any other provisions of 780 CMR plastic materials which burn at a rate no faster than 2.5 inches per minute (64 mm/s) when tested in accordance with ASTM D 635 shall be deemed approved plastics and can be used as the display surface material and for the letters, decorations and facings on *outdoor* signs and outdoor display structures.

Note: For signs, other than those identified in 780 CMR 120.H101.2 and that are used indoors, plastic sign materials shall conform to the applicable requirements set forth in 780 CMR 26.00.

120.H107.1.2 Electric Sign Faces. Individual plastic facings of electric signs shall not exceed 200 square feet (18.6 m²) in area.

120.H107.1.3 Area Limitation. If the area of a display surface exceeds 200 square feet (18.6 m²), the area occupied or covered by approved plastics shall be limited to 200 square feet (18.6 m²) plus 50% of the difference between 200 square feet (18.6 m²) and the area of display surface. The area of plastic on a display surface shall not in any case exceed 1,100 square feet (102 m²).

120.H107.1.4 Plastic Appurtenances. Letters and decorations mounted on an approved plastic facing or display surface can be made of approved plastics.

780 CMR 120.H108 ANIMATED DEVICES

120.H108.1 Fail-safe Device. Signs that contain moving sections or ornaments shall have fail-safe provisions to prevent the section or ornament from releasing and falling or shifting its center of gravity more than 15 inches (381 mm). The fail-safe device

shall be in addition to the mechanism and the mechanism's housing which operate the movable section or ornament. The fail-safe device shall be capable of supporting the full dead weight of the section or ornament when the moving mechanism releases.

780 CMR 120.H109 GROUND SIGNS

120.H109.1 Height Restrictions. The structural frame of ground signs shall not be erected of combustible materials to a height of more than 35 feet (10668 mm) above the ground. Ground signs constructed entirely of noncombustible material shall not be erected to a height of greater than 100 feet (30480 mm) above the ground. Greater heights are permitted where approved and located so as not to create a hazard or danger to the public.

120.H109.2 Required Clearance. The bottom coping of every ground sign shall be not less than three feet (914 mm) above the ground or street level, which space can be filled with platform decorative trim or light wooden construction.

120.H109.3 Wood Anchors and Supports. Where wood anchors or supports are embedded in the soil, the wood shall be pressure treated with an approved preservative.

780 CMR 120.H110 ROOF SIGNS

120.H110.1 General. Roof signs shall be constructed entirely of metal or other approved noncombustible material except as provided for in 780 CMR 120.H106.1.1 and 120.H107.1. Provisions shall be made for electric grounding of metallic parts. Where combustible materials are permitted in letters or other ornamental features, wiring and tubing shall be kept free and insulated there from. Roof signs shall be so constructed as to leave a clear space of not less than six feet (1829 mm) between the roof level and the lowest part of the sign and shall have at least five feet (1524 mm) clearance between the vertical supports thereof. No portion of any roof sign structure shall project beyond an exterior wall.

Exception: Signs on flat roofs with every part of the roof accessible.

120.H110.2 Bearing Plates. The bearing plates of roof signs shall distribute the load directly to or upon masonry walls, steel roof girders, columns or beams. The building shall be designed to avoid overstress of these members.

120.H110.3 Height of Solid Signs. A roof sign having a solid surface shall not exceed, at any point, a height of 24 feet (7315 mm) measured from the roof surface.

120.H110.4 Height of Open Signs. Open roof signs in which the uniform open area is not less than 40% of total gross area shall not exceed a height of 75 feet

(22 860 mm) on buildings of Type 1 or Type 2 construction. On buildings of other construction types, the height shall not exceed 40 feet (12 192 mm). Such signs shall be thoroughly secured to the building upon which they are installed, erected or constructed by iron, metal anchors, bolts, supports, chains, stranded cables, steel rods or braces and they shall be maintained in good condition.

120.H110.5 Height of Closed Signs. A closed roof sign shall not be erected to a height greater than 50 feet (15 240 mm) above the roof of buildings of Type 1 or Type 2 construction, nor more than 35 feet (10 668 mm) above the roof of buildings of Type 3, 4 or 5 construction.

780 CMR 120.H111 WALL SIGNS

120.H111.1 Materials. Wall signs which have an area exceeding 40 square feet (3.72 m²) shall be constructed of metal or other approved noncombustible material, except for nailing rails and as provided for in 780 CMR H106.1.1 and H107.1.

120.H111.2 Exterior Wall Mounting Details. Wall signs attached to exterior walls of solid masonry, concrete or stone shall be safely and securely attached by means of metal anchors, bolts or expansion screws of not less than 3/8 inch (9.5 mm) diameter and shall be embedded at least five inches (127 mm). Wood blocks shall not be used for anchorage, except in the case of wall signs attached to buildings with walls of wood. A wall sign shall not be supported by anchorages secured to an unbraced parapet wall.

120.H111.3 Extension. Wall signs shall not extend above the top of the wall, nor beyond the ends of the wall to which the signs are attached unless such signs conform to the requirements for roof signs, projecting signs or ground signs.

780 CMR 120.H112 PROJECTING SIGNS

120.H112.1 General. Projecting signs shall be constructed entirely of metal or other noncombustible material and securely attached to a building or structure by metal supports such as bolts, anchors, supports, chains, guys or steel rods. Staples or nails shall not be used to secure any projecting sign to any building or structure. The dead load of projecting signs not parallel to the building or structure and the load due to wind pressure shall be supported with chains, guys or steel rods having net cross-sectional dimension of not less than 3/8 inch (9.5 mm) diameter. Such supports shall be erected or maintained at an angle of at least 45% (0.78 rad) with the horizontal to resist the dead load and at angle of 45% (0.78 rad) or more with the face of the sign to resist the specified wind pressure. If such projecting sign exceeds 30 square feet (2.8 m²) in one facial area, there shall be provided at least two such supports on each side not more than eight feet (2438 mm) apart to resist the wind pressure.

120.H112.2 Attachment of Supports. Supports shall be secured to a bolt or expansion screw that will develop the strength of the supporting chains, guys or steel rods, with a minimum 5/8-inch (15.9 mm) bolt or lag screw, by an expansion shield. Turn buckles shall be placed in chains, guys or steel rods supporting projecting signs.

120.H112.3 Wall Mounting Details. Chains, cables, guys or steel rods used to support the live or dead load of projecting signs are permitted to be fastened to solid masonry walls with expansion bolts or by machine screws in iron supports, but such supports shall not be attached to an unbraced parapet wall. Where the supports must be fastened to walls made of wood, the supporting anchor bolts must go through the wall and be plated or fastened on the inside in a secure manner.

120.H112.4 Height Limitation. A projecting sign shall not be erected on the wall of any building so as to project above the roof or cornice wall or above the roof level where there is no cornice wall; except that a sign erected at a right angle to the building, the horizontal width of which sign is perpendicular to such a wall and does not exceed 18 inches (457 mm), is permitted to be erected to a height not exceeding two feet (610 mm) above the roof or cornice wall or above the roof level where there is no cornice wall. A sign attached to a corner of a building and parallel to the vertical line of such corner shall be deemed to be erected at a right angle to the building wall.

120.H112.5 Additional Loads. Projecting sign structures which will be used to support an individual on a ladder or other servicing device, whether or not specifically designed for the servicing device, shall be capable of supporting the anticipated additional load, but not less than a 100-pound (445

N) concentrated horizontal load and a 300-pound (1334 N) concentrated vertical load applied at the point of assumed or most eccentric loading. The building component to which the projecting sign is attached shall also be designed to support the additional loads.

780 CMR 120.H113 MARQUEE SIGNS

120.H113.1 Materials. Marquee signs shall be constructed entirely of metal or other approved noncombustible material except as provided for in 780 CMR 120.H106.1.1 and 120.H107.1.

120.H113.2 Attachment. Marquee signs shall be attached to approved marquees that are constructed in accordance with 780 CMR 3106.

120.H113.3 Dimensions. Marquee signs, whether on the front or side, shall not project beyond the perimeter of the marquee.

120.H113.4 Height Limitation. Marquee signs shall not extend more than six feet (1829 mm) above, nor one foot (305 mm) below such marquee, but under no circumstances shall the sign or signs have a vertical dimension greater than eight feet (2438 mm).

782 CMR 120.H114 PORTABLE SIGNS

120.H114.1 General. Portable signs shall conform to requirements for ground, roof, projecting, flat and temporary signs where such signs are used in a similar capacity. The requirements of this section shall not be construed to require portable signs to have connections to surfaces, tie-downs or foundations where provisions are made by temporary means or configuration of the structure to provide stability for the expected duration of the installation.

Table 120.H 4-A
SIZE, THICKNESS AND TYPES OF GLASS PANELS IN SIGNS

MAXIMUM SIZE OF EXPOSED PANEL		MINIMUM THICKNESS OF GLASS (inches)	TYPE OF GLASS
Any dimension (inches)	Area (square inches)		
30	500	1/8	Plain, plate or wired
45	700	3/16	Plain, plate or wired
144	3,600	1/4	Plain, plate or wired
>144	>3,600	1/4	Wired glass

For SI: 1 inch = 25.4 mm 1 square inch = 645mm²

TABLE 120.H 4-B
THICKNESS OF PROJECTION SIGN

PROJECTION (feet)	MAXIMUM THICKNESS (feet)
5	2
4	2.5
3	3
2	3.5
1	4

For SI: 1 foot = 304.8 mm

780 CMR 120.H115 REFERENCED STANDARDS

ASTM D 635-98	Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position	120.H107.1.1
527 CMR 12.00	Massachusetts Electrical Code	120.H106.1, 120.H106.2
NFPA 701-99	Methods of Fire Test for Flame Propagation of Textiles and Films	120.H106.1.1

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NON-TEXT PAGE

780 CMR 120.I**PATIO COVERS**

(Note: 780 CMR 120.I is unique to Massachusetts)

780 CMR 120.II01 GENERAL

120.II01.1 Scope. Patio covers shall conform to the requirements of 780 CMR 120.I. Patio covers shall be permitted to be detached from or attached to dwelling units and other Use Group structures. Patio covers shall be used only for recreational, outdoor living purposes and not as carports, garages, storage rooms or habitable rooms. Openings shall be permitted to be enclosed with insect screening, approved translucent or transparent plastic not more than 0.125 inch (3.2 mm) in thickness, glass conforming to the provisions of 780 CMR 53.00 for one- and two-family dwellings or 780 CMR 24.00 for all other USE Groups or any combination of the foregoing

780 CMR 120.II02 DEFINITION

120.II02.1 General. The following term shall, for the purposes of 780 CMR 120.I have the meaning shown in 780CMR 120.II02.

PATIO COVERS. One-story structures not exceeding 12 feet (3657 mm) in height. Enclosure walls shall be permitted to be of any configuration, provided the open or glazed area of the longer wall and one additional wall is equal to at least 65% of the area below a minimum of six feet eight inches (2032 mm) of each wall, measured from the floor. Openings shall be permitted to be enclosed with:

1. insect screening,
2. approved translucent or transparent plastic not more than 0.125 inch (3.2 mm) in thickness,
3. glass conforming to the provisions of 780 CMR 5308.0, or 780 CMR 24.00 as applicable or
4. any combination of the foregoing.

780 CMR 120.II03 STRUCTURAL PROVISIONS

120.II03.1 General. Patio covers shall be designed and constructed to sustain, within the stress limits of 780 CMR, all dead loads plus a minimum vertical live load of ten pounds per square foot (0.48 kN/m²) except that snow loads shall be used where such snow loads exceed this minimum. Such patio covers shall be designed to resist the minimum wind and seismic loads set forth in 780 CMR, as applicable.

120.II03.2 Footings. Patio covers shall be erected on permanent supports extending a minimum of four feet (1.2m) below finished grade except when such supports are placed on solid rock or otherwise protected from frost. All patio cover supports shall be designed for the loads required carried

780 CMR 120.II04 LIGHT AND VENTILATION/EMERGENCY EGRESS

120.II04.1 General. Exterior openings required for light and ventilation shall be permitted to open into a patio structure conforming to 780 CMR 120.I, provided that the patio structure shall be unenclosed if such openings are serving as emergency egress or rescue openings from sleeping rooms. Where such exterior openings serve as an exit from the dwelling unit, the patio structure, unless unenclosed, shall be provided with exits conforming to the provisions of 780 CMR 10.00 or 780 CMR 53.00, as applicable.

780 CMR 120.II05 SPECIAL PROVISIONS FOR ALUMINUM SCREEN ENCLOSURES IN HURRICANE-PRONE REGIONS

120.II05.1 General. Screen enclosures in hurricane-prone regions shall be in accordance with the provisions of 780 CMR 120.II05

120.II05.1.1 Habitable Spaces. Screen enclosures shall not be considered habitable spaces.

120.II05.1.2 Minimum Ceiling Height. Screen enclosures shall have a ceiling height of not less than seven feet (2134 mm) for one- and two-family detached dwellings and seven feet six inches (2286 mm) for all other applications.

120.II05.2 Definitions.

20.II05.1 The following term shall, for the purposes of 780 CMR 120.I, have the meaning shown in 780 CMR 120.II05.2

SCREEN ENCLOSURE. A building or part thereof, in whole or in part self-supporting, and having walls of insect screening and a roof of insect screening, plastic, aluminum, or similar lightweight material.

120.II05.3 Screen Enclosures Minimum Specifications.

120.II05.3.1 Thickness. Actual wall thickness of extruded aluminum members shall be not less than 0.040 inches (1.02 mm).

120.II05.3.2 Density. Screen density shall be a maximum of 20 threads per inch by 20 threads per inch mesh.

120.II05.4 Design.

120.II05.4.1 Wind Load. Structural members supporting screen enclosures shall be designed to support minimum wind loads given in 780 CMR Table 120.II05.4(1) and 120.II05.4(2). Where any value is less than ten psf (0.479 kN/m²) use ten psf (0.479 kN/m²).

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120.I105.4.2 Deflection Limit. For members supporting screen surfaces only, the total load deflection shall not exceed 1/60. Screen surfaces shall be permitted to include a maximum of 25% solid flexible finishes.

120.I105.4.3 Importance Factor. Utilizing ASCE-7, as referenced in 780 CMR 1604.5, the

wind factor for screen enclosures shall be 0.77.

120.I105.4.4 Roof Live Load. The minimum roof live load shall be ten psf (0.479 kN/m²) except that snow loads shall be used where such snow loads exceed this minimum.

**780 CMR TABLE 120.I105.4(1)
DESIGN WIND PRESSURES FOR ALUMINUM SCREEN ENCLOSURE FRAMING
WITH AN IMPORTANCE FACTOR OF 0.77^{a, b, c}**

LOAD CASE	WALL	Basic Wind Speed (mph)											
		100		110		120		130		140		150	
		Exposure Category Design Pressure (psf)											
		C	B	C	B	C	B	C	B	C	B	C	B
A ^d	Windward and leeward walls (flow through) and windward wall (non-flow through) L/W = 0-1	12	8	14	10	17	12	19	14	23	16	26	18
A ^d	Windward and leeward walls (flow through) and windward wall (non-flow through) L/W = 2	13	9	16	11	19	14	22	16	26	18	30	21
B ^c	Windward: Non-gable roof	16	12	20	14	24	17	28	20	32	23	37	26
B ^c	Windward: Gable roof	22	16	27	19	32	23	38	27	44	31	50	36
	ROOF												
All ^f	Roof-screen	4	3	5	4	6	4	7	5	8	6	9	7
All ^f	Roof-solid	12	9	15	11	18	13	21	15	24	17	28	20

For SI: One mile per hour = 0.44 m/s, one pound per square foot = 0.0479kPa, one foot = 304.8 mm.

- Values have been reduced for 0.77 Importance Factor in accordance with 780 CMR 1604.5 and ASCE-7.
- Minimum design pressure shall be ten psf in accordance with 780 CMR 1609. If a higher design pressure is determined, then that higher design pressure shall be utilized.
- Loads are applicable to screen enclosures with a mean roof height of 30 feet or less. For screen enclosures of different heights the pressures given shall be adjusted by multiplying the applicable pressure from 780 CMR Table 120.I105.4(1) by the adjustment factor given in 780 CMR Table 120.I105.4(2).
- For Load Case A flow-through condition, the pressure given shall be applied simultaneously to both the upwind and downwind screen walls acting in the same direction as the wind. The structure shall also be analyzed for wind coming from the opposite direction. For the non-flow through condition, the screen enclosure wall shall be analyzed for the load applied acting toward the interior of the enclosure.
- For Load Case B, the appropriate Table 120.I105.4(1) pressure multiplied by the projected frontal area of the screen enclosure is the total drag force, including drag on screen surfaces parallel to the wind, which must be transmitted to the ground. Use Load Case A for members directly supporting the screen surfaces perpendicular to the wind. Load Case B loads shall be applied only to structural members which carry wind loads from more than one surface.
- The roof structure shall be analyzed for the pressure given occurring both upward and downward.

**780 CMR TABLE 120.I105.4(2)
HEIGHT ADJUSTMENT FACTORS**

Mean Roof Height (ft)	EXPOSURE	
	B	C
15	1	0.86
20	1	0.92
25	1	0.96
30	1	1.00
35	1.05	1.03
40	1.09	1.06
45	1.12	1.09
50	1.16	1.11
55	1.19	1.14
60	1.22	1.16

For SI: One foot = 304.8 mm.

780 CMR 120.J**GRADING****780 CMR 120.J101 GENERAL**

120.J101.1 Scope. *The provisions of 780 CMR 120.J apply to grading, excavation and earthwork construction, including fills and embankments only when directly associated with the construction, reconstruction, alteration, repair and/or demolition of buildings and structures (see M.G.L. c.143, §§ 93 through 100). Where conflicts occur between the technical requirements of 780 CMR 120.J and the soils report, the soils report shall govern.*

120.J101.1.1 Appendix Limits Further Delineated. *780 CMR 120.J, contains grading provisions that address soil-related hazards such as slope failure, landslides and erosion that can be encountered in large commercial building developments or in large residential subdivisions where grading problems may arise and that are otherwise not addressed by 780 CMR.*

120.J101.2 Flood Hazard Areas. *The provisions of 780 CMR 120.J shall not apply to grading, excavation and earthwork construction, including fills and embankments, in floodways within flood hazard areas established in 780 CMR 1612 and 780 CMR 120.G unless it has been demonstrated through hydrologic and hydraulic analyses performed in accordance with standard engineering practice that the proposed work will not result in any increase in the level of the base flood.*

Note 1: Before commencing digging, Massachusetts state law requires advance notice of at least 72 hours in Massachusetts (excluding weekends and holidays) before you get ready to begin your outdoor project. One call to Dig Safe is all it takes to notify all member utility companies of your excavation project. In turn, these utilities respond to the work area and mark the location of their underground facilities. Callers are given a permit number as confirmation. Before digging, first call "Dig Safe" (1-888-DIG-SAFE).

Note 2: Proposed grading activity in and around wetlands and other areas subject either to the requirements of M.G.L. c. 131, § 40 or certain Department of Environmental Protection regulations must also conform to such other requirements.

780 CMR 120.J102 DEFINITIONS

120.J102.1 Definitions. *For the purposes of 780 CMR 120.J, the terms, phrases and words listed in 780 CMR 120.J102 and their derivatives shall have the indicated meanings.*

BENCH. *A relatively level step excavated into earth material on which fill is to be placed.*

COMPACTION. *The densification of a fill by mechanical means.*

CUT. *See Excavation.*

DOWNDRAIN. *A device for collecting water from a swale or ditch located on or above a slope, and safely delivering it to an approved drainage facility*

EROSION. *The wearing away of the ground surface as a result of the movement of wind, water or ice.*

EXCAVATION. *The removal of earth material by artificial means, also referred to as a cut.*

FILL. *Deposition of earth materials by artificial means.*

GRADE. *The vertical location of the ground surface.*

GRADE, EXISTING. *The grade prior to grading.*

GRADE, FINISHED. *The grade of the site at the conclusion of all grading efforts.*

GRADING. *An excavation or fill or combination thereof.*

KEY. *A compacted fill placed in a trench excavated in earth material beneath the toe of a slope.*

All slope references in the chapter have been modified to show the horizontal:vertical relationship.

SLOPE. *An inclined surface, the inclination of which is expressed as a ratio of horizontal distance to vertical distance.*

TERRACE. *A relatively level step constructed in the face of a graded slope for drainage and maintenance purposes.*

780 CMR 120.J103 PERMITS REQUIRED

120.J103.1 Permits Required. *Except as exempted in 780 CMR 120.J103.2, no grading directly associated with building/structure construction/reconstruction/repair/demolition shall be performed without first having obtained a permit therefor from the building official. A grading permit does not include the construction of retaining walls or other structures – a separate permit for retaining wall systems is required where retaining walls are large enough to require a building permit (see 780 CMR 110).*

120.J103.2 Exemptions. *A grading permit shall not be required for the following:*

1. *Grading in an isolated, self-contained area, provided there is no danger to the public, and that such grading will not adversely affect adjoining properties.*
2. *Excavation for construction of a structure*

permitted under 780 CMR.

3. Cemetery graves.
4. Refuse disposal sites controlled by other regulations.
5. Excavations for wells, or trenches for utilities.
6. Mining, quarrying, excavating, processing or stockpiling rock, sand, gravel, aggregate or clay controlled by other regulations, provided such operations do not affect the lateral support of, or significantly increase stresses in, soil on adjoining properties.
7. *Exploratory excavations performed under the direction of a registered design professional "Exploratory excavation" is not to be construed as allowing construction of a building to begin prior to receiving a permit for the sole purpose of preparing a soils report.*
8. *Grading not directly associated with building or structure construction / reconstruction / repair / demolition regulated by 780 CMR.*

Exemption from the permit requirements of 780 CMR 120.J shall not be deemed to grant authorization for any work to be done in any manner in violation of the provisions of 780 CMR or any other laws or ordinances of this jurisdiction.

780 CMR 120.J104 PERMIT APPLICATION AND SUBMITTALS

120.J104.1 Submittal Requirements. In addition to the provisions of 780 CMR 105.3, the applicant shall state the estimated quantities of excavation and fill.

120.J104.2 Site Plan Requirements. In addition to the provisions of 780 CMR 106, a grading plan shall show the existing grade and finished grade in contour intervals of sufficient clarity to indicate the nature and extent of the work and show in detail that it complies with the requirements of 780 CMR. Drafting requirements were deleted here. The plans shall show the existing grade on adjoining properties in sufficient detail to identify how grade changes will conform to the requirements of 780 CMR.

120.J104.3 Soils Report. A soils report prepared by registered design professionals shall be provided which shall identify the nature and distribution of existing soils; conclusions and recommendations for grading procedures; soil design criteria for any structures or embankments required to accomplish the proposed grading; and, where necessary, slope stability studies, and recommendations and conclusions regarding site geology.

Exception: A soils report is not required where the building official determines that the nature of the work applied for is such that a report is not necessary.

120.J104.4 Liquefaction Study. For sites with mapped maximum considered earthquake spectral response accelerations at short periods (S_s) greater

than 0.5g as determined by 780 CMR 1615, a study of the liquefaction potential of the site shall be provided, and the recommendations incorporated in the plans – *note that seismic evaluation is not required for one- and two-family detached dwellings.*

Exception: A liquefaction study is not required where the building official is provided with acceptable technical evidence, determined by a design professional (Massachusetts registered architect or engineer) that determines from established local data that the liquefaction potential is low.

780 CMR 120.J105 INSPECTIONS

120.J105.1 General. Inspections shall be governed by 780 CMR 109.

120.J105.2 Special Inspections. The special inspection requirements of 780 CMR 1704.7 shall apply to work performed under a grading permit where required by the building official.

780 CMR 120.J106 EXCAVATIONS

120.J106.1 Maximum Slope. The slope of cut surfaces shall be no steeper than is safe for the intended use, and shall be no steeper than two horizontal to one vertical (50%) unless the applicant furnishes a soils report justifying a steeper slope.

Exceptions:

1. A cut surface may be at a slope of 1.5 horizontal to one vertical (67%) provided that all the following are met:
 - 1.1. It is not intended to support structures or surcharges.
 - 1.2. It is adequately protected against erosion.
 - 1.3. It is no more than eight feet (2438 mm) in height.
 - 1.4. It is approved by the building official.
2. A cut surface in bedrock shall be permitted to be at a slope of one horizontal to one vertical (100%).

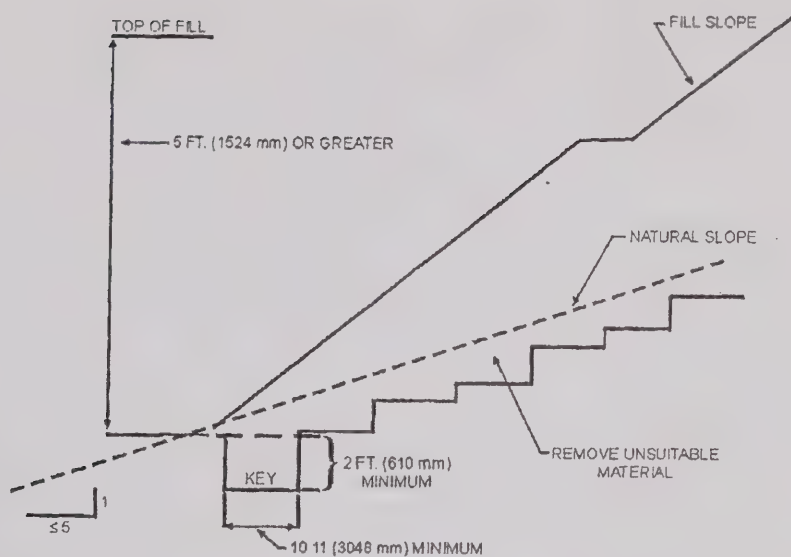
780 CMR 120.J107 FILLS

120.J107.1 General. Unless otherwise recommended in the soils report, fills shall conform to provisions of 780 CMR 120.J107.

120.J107.2 Surface Preparation. The ground surface shall be prepared to receive fill by removing vegetation, topsoil and other unsuitable materials, and scarifying the ground to provide a bond with the fill material.

120.J107.3 Benching. Where existing grade is at a slope steeper than five horizontal to one vertical (20 percent) and the depth of the fill exceeds five feet (1524 mm) benching shall be provided in accordance with Figure 780 CMR 120.J107.3. A key shall be provided which is at least ten feet (3048 mm) in width and two feet (610 mm) in depth.

Figure 780 CMR 120.J107.3
BENCHING DETAILS



For SI: one foot = 304.8 mm

120.J107.4 Fill Material. Fill material shall not include organic, frozen or other deleterious materials. No rock or similar irreducible material greater than 12 inches (305 mm) in any dimension shall be included in fills.

120.J107.5 Compaction. All fill material shall be compacted to 90% of maximum density as determined by ASTM D1557, Modified Proctor, in lifts not exceeding 12 inches (305 mm) in depth.

120.J107.6 Maximum Slope. The slope of fill surfaces shall be no steeper than is safe for the intended use. Fill slopes steeper than two horizontal to one vertical (50%) shall be justified by soils reports or engineering data.

780 CMR 120.J108 SETBACKS

120.J108.1 General. Cut and fill slopes shall be set back from the property lines in accordance with 780 CMR 120.J108. Setback dimensions shall be measured perpendicular to the property line and shall be as shown in Figure 780 CMR J108.1, unless

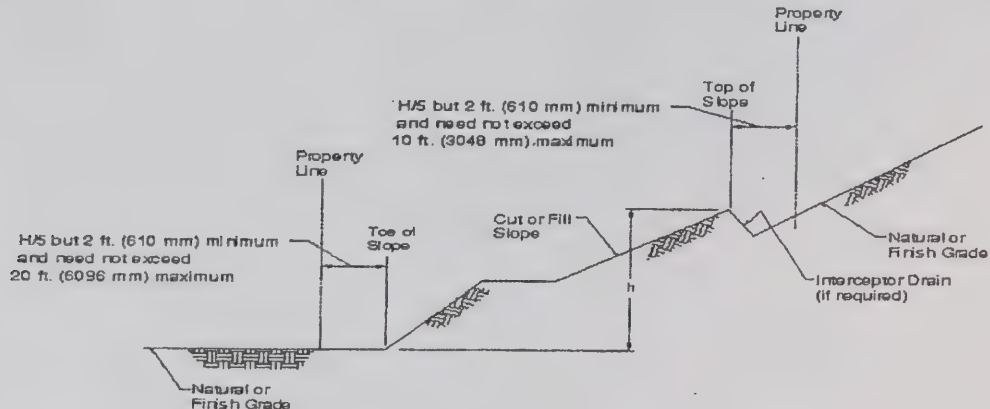
substantiating data is submitted justifying reduced setbacks.

120.J108.2 Top of Slope. The setback at the top of a cut slope shall not be less than that shown in Figure 780 CMR 120.J108.1, or than is required to accommodate any required interceptor drains, whichever is greater.

120.J108.3 Slope Protection. Where required to protect adjacent properties at the toe of a slope from adverse effects of the grading, additional protection, approved by the building official, shall be included. Such protection may include but shall not be limited to:

1. Setbacks greater than those required by Figure 780 CMR 120.J108.1.
2. Provisions for retaining walls or similar construction.
3. Erosion protection of the fill slopes.
4. Provision for the control of surface waters.

Figure 780 CMR 120.J108.1
DRAINAGE DIMENSIONS



For SI: One foot - 304.8 mm

780 CMR 120.J109 DRAINAGE AND TERRACING

120.J109.1 General. Unless otherwise recommended by a registered design professional, drainage facilities and terracing shall be provided in accordance with the requirements of 780 CMR 120.J109.

Exception: Drainage facilities and terracing need not be provided where the ground slope is not steeper than three horizontal to one vertical (33%).

120.J109.2 Terraces. Terraces at least six feet (1829 mm) in width shall be established at not more than 30-foot (9144 mm) vertical intervals on all cut or fill slopes to control surface drainage and debris. Suitable access shall be provided to allow for cleaning and maintenance.

Where more than two terraces are required, one terrace, located at approximately mid-height, shall be at least 12 feet (3658 mm) in width.

Swales or ditches shall be provided on terraces. They shall have a minimum gradient of 20 horizontal to one vertical (5%) and shall be paved with concrete not less than three inches (76 mm) in thickness, or with other materials suitable to the application. They shall have a minimum depth of 12 inches (305 mm) and a minimum width of five feet (1524 mm).

A single run of swale or ditch shall not collect runoff from a tributary area exceeding 13,500 square feet (1256 m²) (projected) without discharging into a down drain.

120.J109.3 Interceptor Drains. Interceptor drains shall be installed along the top of cut slopes receiving drainage from a tributary width greater than 40 feet, measured horizontally. They shall have

a minimum depth of one foot (305 mm) and a minimum width of three feet (915 mm). The slope shall be approved by the building official, but shall not be less than 50 horizontal to one vertical (2%). The drain shall be paved with concrete not less than three inches (76 mm) in thickness, or by other materials suitable to the application. Discharge from the drain shall be accomplished in a manner to prevent erosion and shall be approved by the building official.

120.J109.4 Drainage Across Property Lines. Drainage across property lines shall not exceed that which existed prior to grading. Excess or concentrated drainage shall be contained on site or directed to an approved drainage facility. Erosion of the ground in the area of discharge shall be prevented by installation of nonerosive down drains or other devices.

780 CMR 120.J110 EROSION CONTROL

120.J110.1 General. The faces of cut and fill slopes shall be prepared and maintained to control erosion. This control shall be permitted to consist of effective planting.

Exception: Erosion control measures need not be provided on cut slopes not subject to erosion due to the erosion-resistant character of the materials.

Erosion control for the slopes shall be installed as soon as practicable and prior to calling for final inspection.

120.J110.2 Other Devices. Where necessary, check dams, cribbing, riprap or other devices or methods shall be employed to control erosion and provide safety.

780 CMR 120.J111 REFERENCED STANDARDS

ASTM D 1557-00

Test Method for Laboratory Compaction
Characteristics of Soil Using Modified Effort [56,000
ft-lbs/ft³ (2,700kN-m/m³)]

120.J107.5

780 CMR 120.K

MANUFACTURED HOUSING USED AS DWELLINGS

780 CMR 120.K101 SCOPE

120.K101.1 General, One- and Two-family Dwellings. 780 CMR 120.K101.1, Items 1. through 3. shall be applicable only to a manufactured home used as a single or two-family dwelling unit and shall apply to the following:

1. Construction, alteration and repair of any foundation system which is necessary to provide for the installation of a manufactured home unit.
2. Construction, installation, addition, alteration, repair or maintenance of the building service equipment which is necessary for connecting manufactured homes to water, fuel, or power supplies and sewage systems (*refer to requirements of the Specialized Codes*).
3. Alterations, additions or repairs to existing manufactured homes. The construction, alteration, moving, demolition, repair and use of accessory buildings and structures and their building service equipment shall comply with the requirements of the codes adopted by this jurisdiction (*also refer to requirements of the Specialized Codes*).

780 CMR 120.K101.1, Items 1. through 3. shall not be applicable to the design and construction of manufactured homes and shall not be deemed to authorize either modifications or additions to manufactured homes where otherwise prohibited.

Exception: In addition to 780 CMR 120.K101.1, new and replacement manufactured homes to be located in flood hazard areas as established in 780 CMR Table 5301.2(1) shall meet the applicable requirements of 780 CMR 5323 and 780 CMR 120.G.

780 CMR 120.K102 APPLICATION TO EXISTING MANUFACTURED HOMES AND BUILDING SERVICE EQUIPMENT

120.K102.1 General. Manufactured homes and their building service equipment to which additions, alterations or repairs are made shall comply with all the requirements of 780 CMR 120.K for new facilities, except as specifically provided in 780 CMR 120.K102.

120.K102.2 Additions, Alterations or Repairs. Additions made to a manufactured home shall be in accordance with the applicable requirements of 780 CMR and of the Specialized Codes.

Building permissible alterations or repairs to an existing manufactured home which are nonstructural and do not adversely affect any structural member or any part of the building or structure *and are in compliance with required fire protection and in compliance with energy conservation requirements* may be made with materials equivalent to those of

which the manufactured home structure is constructed, subject to approval by the building official.

Exception: The installation or replacement of glass shall be *in conformance with all energy related and safety glazing related requirements of 780 CMR*.

120.K102.3 Existing Installations. For building service equipment lawfully in existence at the time of the adoption of the applicable codes - *see the requirements of the Specialized Codes*

120.K102.4 Existing Occupancy. Manufactured homes which are in existence at the time of the adoption of 780 CMR 120.K may have their existing use or occupancy continued if such use or occupancy was legal at the time of the adoption of 780 CMR 120.K provided such continued use is not dangerous to life, health and safety.

The use or occupancy of any existing manufactured home shall not be changed unless evidence satisfactory to the building official is provided to show compliance with all applicable provisions of the codes adopted by this jurisdiction. Upon any change in use or occupancy, the manufactured home shall cease to be classified as such within the intent of 780 CMR 120.K

120.K102.5 Maintenance. All manufactured homes and their building service equipment, existing and new, and all parts thereof shall be maintained in a safe and sanitary condition. All *devices* or safeguards which are required by applicable codes or by the Manufactured Home Standards shall be maintained in conformance with the code or standard under which it was installed. The owner or the owner's designated agent shall be responsible for the maintenance of manufactured homes, accessory buildings, structures and their building service equipment. To determine compliance with 780 CMR 120.K102.5, the building official may cause any manufactured home, accessory building or structure to be reinspected.

120.K102.6 Relocation. Manufactured homes which are to be relocated shall comply with the *applicable provisions of 780 CMR 120.K*.

780 CMR 120.K201 DEFINITIONS

120.K201.1 General. For the purpose of 780 CMR 120.K, certain abbreviations, terms, phrases, words and their derivatives shall be construed as defined or specified in 780 CMR 120.K201.

ACCESSORY BUILDING. Any building or structure, or portion thereto, located on the same property as a manufactured home which does not

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qualify as a manufactured home as defined in 780 CMR 120.K201.

BUILDING SERVICE EQUIPMENT. Refers to the plumbing, mechanical and electrical equipment including piping, wiring, fixtures and other accessories which provide sanitation, lighting, heating ventilation, cooling, fire protection and facilities essential for the habitable occupancy of a manufactured home or accessory building or structure for its designated use and occupancy. *(Refer also to the definitions and requirements of the Specialized Codes).*

MANUFACTURED HOME. A structure transportable in one or more sections which, in the traveling mode, is eight body feet (2438 body mm) or more in width or 40 body feet (12 192 body mm) or more in length or, when erected on site, is 320 or more square feet (30 m²), and which is built on a permanent chassis and designed to be used as a dwelling with or without a permanent foundation when connected to the required utilities, and includes the plumbing, heating, air-conditioning and electrical systems contained therein; except that such term shall include any structure which meets all the requirements of 780 CMR 120.K201 MANUFACTURED HOME except the size requirements and with respect to which the manufacturer voluntarily files a certification required by the secretary (HUD) and complies with the standards established under 780 CMR 120.K. For mobile homes built prior to June 15, 1976, a label certifying compliance to the Standard for Mobile Homes, NFPA 501, ANSI 119.1, in effect at the time of manufacture is required. For the purpose of these provisions, a mobile home shall be considered a manufactured home.

MANUFACTURED HOME INSTALLATION.

Construction which is required for the installation of a manufactured home, including the construction of the foundation system, required structural connections thereto and the installation of on-site water, gas, electrical and sewer systems and connections thereto which are necessary for the normal operation of the manufactured home.

MANUFACTURED HOME STANDARDS. The Manufactured Home Construction and Safety Standards as promulgated by the United States Department of Housing and Urban Development.

780 CMR 120.K301 PERMITS

120.K301.1 Initial Installation. A manufactured home shall not be installed on a foundation system reinstalled or altered without first obtaining a permit from the building official. A separate permit shall be required for each manufactured home installation. When approved by the building official, such permit may include accessory buildings and structures and their building service equipment *(when applicable, refer to the Specialized Codes for building service*

equipment requirements) when the accessory buildings or structures will be constructed in conjunction with the manufactured home installation.

120.K301.2 Additions, Alterations and Repairs to a Manufactured Home. A permit shall be obtained to alter, remodel, repair or add accessory buildings or structures to a manufactured home subsequent to its initial installation. Permit issuance and fees therefore shall be in conformance with the codes applicable to the type of work involved.

An addition made to a manufactured home as defined in these provisions shall comply with 780 CMR 120.K.

120.K301.3 Accessory Buildings. Except as provided in 780 CMR 120.K301.1, permits shall be required for all accessory buildings and structures and their building service equipment. Permit issuance and fees therefore shall be in conformance with the codes applicable to the types of work involved.

120.K301.4 Exempted Work. A permit shall not be required for the types of work specifically exempted by the applicable codes. Exemption from the permit requirements of any of said codes shall not be deemed to grant authorization for any work to be done in violation of the provisions of said codes or any other laws or ordinances of this jurisdiction.

**780 CMR 120.K302 APPLICATION
FOR PERMIT**

120.K302.1 Application. To obtain a manufactured home installation permit, the applicant shall first file an application in writing on a building permit form furnished by the building official for that purpose. Every such application shall:

1. Identify and describe the work to be covered by the permit for which application is made.
2. Describe the land on which the proposed work is to be done by legal description, street address or similar description that will readily identify and definitely locate the proposed building or work.
3. Indicate the use or occupancy for which the proposed work is intended.
4. Be accompanied by plans, diagrams, computations and specifications and other data as required in 780 CMR 5110 and 5111, as applicable.
5. Be accompanied by a soil investigation when required by 780 CMR.
6. State the valuation of any new building or structure or any addition, remodeling or alteration to an existing building.
7. Be signed by permittee, or permittee's authorized agent, who may be required to submit evidence to indicate such authority.
8. Give such other data and information as may be required by the building official.

120.K302.2 Plans and Specifications. See 780 CMR 5110 and 5111.

Exception: Where precast, interlocking panelized foundation wall systems are utilized, engineering calculations are required.

120.K302.3 Information on plans and specifications. See 780 CMR generally and 780 CMR 5110 and 5111.

780 CMR 120.K303 PERMITS ISSUANCE

120.K303.1 Issuance. See 780 CMR 5110 and 5111.

120.K303.2 Retention of Plans. See 780 CMR 5111.

120.K303.3 Validity of Permit. See 780 CMR 5111.

120.K303.4 Expiration. See 780 CMR 5111.8

120.K303.5 Suspension or Revocation. See 780 CMR 5111.12.

780 CMR 120.K304 FEES

120.K304.1 Permit Fees. See 780 CMR 5114.

780 CMR 120.K305 INSPECTIONS

120.K305.1 General. See 780 CMR 5115.

120.K305.2 Required inspections.

120.K305.2.1 Structural Inspections for the Manufactured Home Installation. See 780 CMR 5115.2.

780 CMR 120.K306 MANUFACTURER'S INSTALLATION REQUIREMENTS

120.K306.1 Manufacturer's Installation instructions. The installation instructions as provided by the manufacturer of the manufactured home shall be used to determine permissible points of support for vertical loads and points of attachment for anchorage systems used to resist horizontal and uplift forces.

780 CMR 120.K307 FOUNDATION SYSTEMS

120.K307.1 General. Foundation systems designed and constructed for Manufactured Housing used as residential dwellings must be considered as a permanent foundations designed and placed to address frost conditions.

120.K307.2 Foundation Design. See 780 CMR generally and 780 CMR 54.00 specifically.

120.K308 SKIRTING AND PERIMETER ENCLOSURES

120.K308.1 Skirting and Permanent Perimeter Enclosures. Skirting and permanent perimeter enclosures shall be installed only where specifically required by other laws or ordinances. Skirting, when installed, shall be of material suitable for exterior exposure and contact with the ground. Permanent

perimeter enclosures shall be constructed of materials as required by this code for regular foundation construction.

Skirting shall be installed in accordance with the skirting manufacturer's installation instructions. Skirting shall be adequately secured to assure stability, to minimize vibration and susceptibility to wind damage, and to compensate for possible frost heave.

120.K308.2 Retaining Walls. Where retaining walls are used as a permanent perimeter enclosure, they shall resist the lateral displacements of soil or other materials and shall conform to 780 CMR as specified for foundation walls. Retaining walls and foundation walls shall be constructed of approved treated wood, concrete, masonry or other approved materials or combination of materials as for foundations as specified in this code. Siding materials shall extend below the top of the exterior of the retaining or foundation wall or the joint between siding and enclosure wall shall be flashed in accordance with 780 CMR.

780 CMR 120.K309 STRUCTURAL ADDITIONS

120.K309.1 General. Accessory buildings shall not be structurally supported by or attached to a manufactured home unless engineering calculations are submitted to substantiate any proposed structural connection.

Exception: The building official may waive the submission of engineering calculations if it is found that the nature of the work applied for is such that engineering calculations are not necessary to show conformance to 780 CMR.

780 CMR 120.K310 BUILDING SERVICE EQUIPMENT

120.K310.1 General. The installation, alteration, repair, replacement, addition to or maintenance of the building service equipment within the manufactured home shall conform to regulations set forth in the applicable Specialized Codes and otherwise in accordance with the requirements of the Manufacturer of the Manufactured Home. All such work which is located outside the manufactured home shall comply with the applicable Specialized Codes.

780 CMR 120.K311 EXITS

120.K311.1 Site Development. Exterior stairways and ramps which provide egress to the public way shall comply with applicable provisions of 780 CMR.

120.K311.2 Accessory Buildings. Every accessory building or portion thereof shall be provided with exits as required by 780 CMR.

**780 CMR 120.K312 OCCUPANCY, FIRE
SAFETY AND ENERGY CONSERVATION
STANDARDS**

120.K312.1 General. Alterations made to a manufactured home subsequent to its initial installation shall conform to the occupancy, fire-safety and energy conservation requirements set forth in the Manufactured Home Standards or 780 CMR when applicable.

**780 CMR 120.K313 SPECIAL REQUIREMENTS
FOR FOUNDATION SYSTEMS**

120.K313.1 General. 780 CMR 120.K310 is applicable only when specifically authorized by the building official and the building official is provided appropriate engineering support of intended foundation design.

**780 CMR 120.K314 FOOTINGS AND
FOUNDATIONS**

120.K314.1 General. The capacity of individual load-bearing piers and their footings shall be sufficient to sustain all loads specified in this code within the stress limitations specified in 780 CMR. Footings, unless otherwise approved by the building official, shall be placed level on firm, undisturbed soil or an engineered fill which is free of organic material, such as weeds and grasses. Where used, an engineered fill shall provide a minimum load-bearing capacity of not less than 1,000 psf (48 kN/m²). Continuous footings shall conform to the requirements of 780 CMR. 780 CMR 120.K307 shall apply to footings and foundations constructed under the provisions of 780 CMR 120.K314.

780 CMR 120.K315 PIER CONSTRUCTION

120.K315.1 General. Piers shall be designed and constructed to distribute loads evenly. Multiple section homes may have concentrated roof loads which will require special consideration. Load-bearing piers may be constructed utilizing one of the methods listed in 780 CMR 120.K315.1 Items 1. through 3. Such piers shall be considered to resist only vertical forces acting in a downward direction. They shall not be considered as providing any resistance to horizontal loads induced by wind or earthquake forces.

1. A prefabricated load-bearing device that is listed and labeled for the intended use.
2. Mortar shall comply with ASTM C 270 Type M, S or N; this may consist of one part portland cement, one-half part hydrated lime and four parts sand by volume. Lime shall not be used with plastic or waterproof cement.
3. A cast-in-place concrete pier with concrete having specified compressive strength at 28 days of 2,500 psi (17 225 kPa).

Alternate materials and methods of construction may be used for piers which have been designed by an

engineer or architect licensed by the state to practice as such.

Caps and leveling spacers may be used for leveling of the manufactured home. Spacing of piers shall be as specified in the manufacturer's installation instructions, if available, or by an approved designer.

780 CMR 120.K316 HEIGHT OF PIERS

120.K316.1 General. Piers constructed as indicated in 780 CMR 120.K316 may have heights as follows:

1. Except for corner piers, piers 36 inches (914 mm) or less in height may be constructed of masonry units, placed with cores or cells vertically. Piers shall be installed with their long dimension at right angles to the main frame member they support and shall have a minimum cross-sectional area of 128 square inches (82 560 mm²). Piers shall be capped with minimum four-inch (102 mm) solid masonry units or equivalent.
2. Piers between 36 and 80 inches (914 mm and 2032 mm) in height and all corner piers over 24 inches (610 mm) in height shall be at least 16 inches by 16 inches (406 mm by 406 mm) consisting of interlocking masonry units and shall be fully capped with minimum four-inch (102 mm) solid masonry units or equivalent.
3. Piers over 80 inches (2032 mm) in height may be constructed in accordance with the provisions of 780 CMR 120.K316.1., Item 2., provided the piers shall be filled solid with grout and reinforced with four continuous No. 5 bars. One bar shall be placed in each corner cell of hollow masonry unit piers or in each corner of the grouted space of piers constructed of solid masonry units.
4. Cast-in-place concrete piers meeting the same size and height limitations of 780 CMR 120.K316.1., Items 1., 2. and 3. may be substituted for piers constructed of masonry units.

**780 CMR 120.K317 ANCHORAGE
INSTALLATIONS**

120.K317.1 Ground Anchors. Ground anchors shall be designed and installed to transfer the anchoring loads to the ground. The load-carrying portion of the ground anchors shall be installed to the full depth called for by the manufacturer's installation directions and shall extend below the established frost line into undisturbed soil.

Manufactured ground anchors shall be listed and installed in accordance with the terms of their listing and the anchor manufacturer's instructions and shall include means of attachment of ties meeting the requirements of 780 CMR 120.K317. Ground anchor manufacturer's installation instructions shall include the amount of preload required and load capacity in various types of soil. These instructions shall include tensioning adjustments which may be needed to prevent damage to the manufactured

home, particularly damage that can be caused by frost heave. Each ground anchor shall be marked with the manufacturer's identification and listed model identification number which shall be visible after installation. Instructions shall accompany each listed ground anchor specifying the types of soil for which the anchor is suitable under the requirements of 780 CMR 120.K317.

Each approved ground anchor, when installed, shall be capable of resisting an allowable working load at least equal to 3,150 pounds (14 kN) in the direction of the tie plus a 50% overload [4,725 pounds (21 kN) total] without failure. Failure shall be considered to have occurred when the anchor moves more than two inches (51 mm) at a load of 4,725 pounds (21 kN) in the direction of the tie installation. Those ground anchors which are designed to be installed so that loads on the anchor are other than direct withdrawal shall be designed and installed to resist an applied design load of 3,150 pounds (14 kN) at 40 to 50 degrees from vertical or within the angle limitations specified by the home manufacturer without displacing the tie end of the anchor more than four inches (102 mm) horizontally. Anchors designed for connection of multiple ties shall be capable of resisting the combined working load and overload consistent with the intent expressed in 780 CMR 120.K317.

When it is proposed to use ground anchors and the building official has reason to believe that the soil characteristics at a given site are such as to render the use of ground anchors advisable, or when there is doubt regarding the ability of the ground anchors to obtain their listed capacity, the building official may require that a representative field installation be made at the site in question and tested to demonstrate ground anchor capacity. The building official shall approve the test procedures.

120.K317.2 Anchoring Equipment. Anchoring equipment, when installed as a permanent installation, shall be capable of resisting all loads as specified within 780 CMR 120.K. When the stabilizing system is designed by an engineer or architect licensed by the state to practice as such, alternative designs may be used, providing the anchoring equipment to be used is capable of withstanding a load equal to 1.5 times the calculated load. All anchoring equipment shall be listed and labeled as being capable of meeting the requirements of 780 CMR 120.K. Anchors as specified in 780 CMR may be attached to the main frame of the manufactured home by an approved $\frac{3}{16}$ -inch-thick (4.76 mm) slotted steel plate anchoring device. Other anchoring devices or methods meeting the requirements of 780 CMR 120.K317 may be permitted when approved by the building official.

Anchoring systems shall be so installed as to be permanent. Anchoring equipment shall be so designed to prevent self-disconnection with no hook

ends used.

120.K317.3 Resistance to Weather Deterioration. All anchoring equipment, tension devices and ties shall have a resistance to deterioration as required by 780 CMR.

120.K317.4 Tensioning Devices. Tensioning devices, such as turnbuckles or yoke-type fasteners, shall be ended with clevis or welded eyes.

780 CMR 120.K318 TIES, MATERIALS AND INSTALLATION

120.K318.1 General. Steel strapping, cable, chain or other approved materials shall be used for ties. All ties shall be fastened to ground anchors and drawn tight with turnbuckles or other adjustable tensioning devices or devices supplied with the ground anchor. Tie materials shall be capable of resisting an allowable working load of 3,150 pounds (14 kN) with no more than 2% elongation and shall withstand a 50% overload [4,750 pounds (21 kN)]. Ties shall comply with the weathering requirements of 780 CMR 120.K317.3. Ties shall connect the ground anchor and the main structural frame. Ties shall not connect to steel outrigger beams which fasten to and intersect the main structural frame unless specifically stated in the manufacturer's installation instructions. Connection of cable ties to main frame members shall be $\frac{5}{8}$ -inch (15.9 mm) closed-eye bolts affixed to the frame member in an approved manner. Cable ends shall be secured with at least two U-bolt cable clamps with the "U" portion of the clamp installed on the short (dead) end of the cable to assure strength equal to that required by 780 CMR 120.K318.

Wood floor support systems shall be fixed to perimeter foundation walls in accordance with provisions of 780 CMR. The minimum number of ties required per side shall be sufficient to resist the wind load stated in 780 CMR. Ties shall be evenly spaced as practicable along the length of the manufactured home with the distance from each end of the home and the tie nearest that end not exceeding eight feet (2438 mm). When continuous straps are provided as vertical ties, such ties shall be positioned at rafters and studs. Where a vertical tie and diagonal tie are located at the same place, both ties may be connected to a single anchor, provided the anchor used is capable of carrying both loadings. Multisection manufactured homes require diagonal ties only. Diagonal ties shall be installed on the exterior main frame and slope to the exterior at an angle of 40 to 50 degrees from the vertical or within the angle limitations specified by the home manufacturer. Vertical ties which are not continuous over the top of the manufactured home shall be attached to the main frame.

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780 CMR 120.K316 REFERENCED STANDARDS

ASTMC 270-01a	Specification for Mortar for Unit Masonry	120.K313
NFP 501-99	Standard on Manufactured Housing	120.K201

780 CMR 120.L

MANUFACTURED BUILDINGS, MANUFACTURED BUILDING
COMPONENTS AND MANUFACTURED HOUSING

(Note: 780 CMR 120.L is unique to Massachusetts)

780 CMR 120.L101 GENERAL

120.L101.1 Scope. The provisions of 780 CMR 120.L shall govern the materials, design, manufacture, handling, storage, transportation, assembly, construction and/or installation of *manufactured buildings* and *manufactured building components* intended for installation in the Commonwealth of Massachusetts. *manufactured buildings* or *manufactured building components* shall not be installed in any jurisdiction of the Commonwealth of Massachusetts unless such *manufactured buildings* or *manufactured building components* have been approved and certified in accordance with 780 CMR 120.L, applicable provisions of 780 CMR, and the Rules and Regulations for *manufactured buildings*, *Manufactured Building Components* and *Manufactured Housing*, 780 CMR 110.R3, as listed in 780 CMR 100.00.

120.L101.2 Manufactured Housing. See 780 CMR 120.K.

780 CMR 120.L102 DEFINITIONS

120.L102.1 General. For the purposes of 780 CMR 120.L and as used elsewhere in 780 CMR, the following words and terms shall have the meaning shown in 780 CMR 120.L.102.1

APPROVED. Approval by the State Board of Building Regulations and Standards (BBRS).

CERTIFICATION. Any manufactured building, manufactured building component or *manufactured housing* which meets the provisions of applicable codes and 780 CMR 110.R3 pursuant thereto, as listed in 780 CMR 35.00 or 100.00, which has been labeled accordingly.

CODE. 780 CMR (The Commonwealth of Massachusetts State Building Code) or specialized codes as defined in 780 CMR and as listed in 780 CMR 35.00 or 780 CMR 100.00

DEPARTMENT (DPS). The Department of Public Safety, Division of Inspections.

INSPECTION AGENCY. An independent agency, sometimes referred to as the "third-party agency," retained by the manufacturer and approved by the BBRS to perform inspections and evaluations of manufactured building systems, compliance assurance programs, *manufactured buildings* and *manufactured building components*.

INSTALLATION. The process of affixing, or assembling and affixing a manufactured building,

manufactured building component or manufactured housing unit(s) on the building site, and connecting it to utilities, and/or to an existing building. Installation may also mean the connecting of two or more manufactured housing units designed and approved to be so connected for use as a dwelling.

INSTALLER OF MANUFACTURED BUILDING. An individual, who on the basis of training and experience, has been certified by a specific manufacturer of manufactured homes as competent to supervise the placement and connection required to install the manufactured homes of that manufacturer. Said certification by the manufacturer shall be in writing; additionally, the certified installer shall possess picture identification in the form of a driver's license or other picture identification acceptable to the building official.

LABEL. An approved device or seal evidencing certification in accordance with the applicable codes and rules and regulations promulgated pursuant thereto, and as listed in 780 CMR 100.R3.

LOCAL ENFORCEMENT AGENCY. A department or agency in a municipality charged with the enforcement of 780 CMR and appropriate Specialized Codes which include, but are not limited to, 248 CMR (the State Fuel Gas and Plumbing Code) and 527 CMR 12.00 (the State Electrical Code), as listed in 780 CMR 35.00.

MANUFACTURED BUILDING. Any manufactured building which has concealed elements, such as electrical, mechanical, plumbing, fire protection, insulation, and other systems affecting health and safety, and which is manufactured or assembled in accordance with 780 CMR and pertinent regulations, in manufacturing facilities, on or off the building site. Also, any manufactured building as defined above which does not have concealed elements, but which has been approved by the BBRS at the request of the manufacturer. "Manufactured building" does not mean "manufactured home."

MANUFACTURED BUILDING COMPONENT. Any manufactured subsystem, manufactured subassembly, or other manufactured system designed for use in or part of a structure having concealed elements such as electrical, mechanical, plumbing and fire protection systems and other systems affecting health and safety, including variations which are submitted as part of the building systems.

MANUFACTURED HOMES (Housing). As defined in 24 CFR, Part 3280.2; a structure, transportable in one or more sections, which in the traveling mode, is eight body feet or more in width or 40 body feet or more in length, or, when erected on site, is 320 or more square feet, and which is built on a permanent chassis and designed to be used as a dwelling with or without a permanent foundation when connected to the required utilities, and includes the plumbing, heating, air-conditioning, and electrical systems contained therein. C120 calculations used to determine the number of square feet in a structure will be based on the structure's exterior dimensions measured at the largest horizontal projections when erected on site. These dimensions will include 120.1 all expandable rooms, cabinets, and other projections containing interior space, but do not include bay windows. (See 24 CFR, Part 3280.2 for a more detailed description of manufactured homes as defined by the Department of Housing and Urban Development.)

SPECIALIZED CODE. All building codes, rules or regulations pertaining to building construction, reconstruction, alteration, repair, or demolition promulgated by and under the authority of the various agencies which have been authorized from time to time by the General Court of the Commonwealth of Massachusetts. The Specialized Codes shall include, but are not limited to, 248 CMR (the State Fuel Gas and Plumbing Code) and 527 CMR 12.00 (the Electrical Code), as listed in 780 CMR 35.00 or 780 CMR 100.00.

780 CMR 120.L103 CONSTRUCTION DOCUMENTS

120.LI03.1 Building System Plans. The building system plans shall show in sufficient detail the approved system to which the manufactured building or building component was produced; including foundation connection details, component connection details, emergency escape window locations and sizes, structural design loads, the manufacturer's data plate, the location of all labels required of 780 CMR 120.L and 780 CMR 110.R3, and other details as may be required by the Division of Inspection. The building system plan shall bear evidence of the approval of the Division of Inspection and evidence of third-party engineering review.

780 CMR 120.L104 APPROVAL

120.LI04.1 General. The Commonwealth of Massachusetts, Department of Public Safety, Division of Inspection (hereinafter referred to as the "Division of Inspection" in 780 CMR 120.L) shall evaluate *manufactured buildings* and building components and recommend approval to the BBRS of those which it determines to be in compliance with applicable sections of 780 CMR 120.L, other applicable sections of 780 CMR, and 780 CMR

110.R3, as listed in 780 CMR 35.00 or 780 CMR 100.00.

All approvals of plumbing, electrical or gas systems shall be made by the appropriate state agencies having jurisdiction, as specified in 780 CMR 110.R3, as listed in 780 CMR 35.00 or 780 CMR 100.00

120.LI04.2 Approved Tests. The Division of Inspection may utilize the results of approved tests to determine whether a manufactured building or manufactured building component meets the requirements of 780 CMR 120.L and the 780 CMR 110.R3 as listed in 780 CMR 35.00 or 780 CMR 100.00, if that determination cannot be made from evaluation of plans, specifications and documentation alone.

120.LI04.3 Approval of Compliance Assurance Programs. The Division of Inspection shall evaluate manufacturers' compliance assurance programs and make recommendations for approval to the BBRS of those which it determines to be in compliance with 780 CMR 120.L and 780 CMR 110.R3, listed in 780 CMR 35.00 or 780 CMR 100.00.

120.LI04.4 Authorization to Vary. A manufactured building, manufactured building component or a compliance assurance program approved in accordance with 780 CMR 120.L103.3, shall not be varied in any way without prior authorization by the BBRS in accordance with 780 CMR 110.R3, as listed in 780 CMR 35.00 or 780 CMR 100.00.

780 CMR 120.L105 CERTIFICATION

120.LI05.1 Labeling. Any manufactured building or manufactured building component heretofore approved, in accordance with 780 CMR 120.L104, shall have an approved device or seal affixed as certification of such approval.

780 CMR 120.L106 RECIPROCITY

120.LI06.1 General. If the BBRS finds that the standards for manufacture and inspection of *manufactured buildings* or *manufactured building components* prescribed by the statutes or the rules and regulations of another state or other governmental agency meet the objectives of 780 CMR 120.L and 780 CMR 110.R3, listed in 780 CMR 35.00 or 780 CMR 100.00, and such standards are enforced satisfactorily by such other state or governmental agency or by its agents, the BBRS may grant approval and the Division of Inspection shall accept all *manufactured buildings* or *manufactured building components* which have been approved in accordance with 780 CMR 120.L106 by such other state or governmental agency and shall insure that the product is properly labeled.

120.LI06.1.1 Condition of Reciprocity. The

standards of another state shall not be deemed to be satisfactorily enforced unless such other state provides for notification to the BBRS of suspensions or revocations of approvals issued by that state, in a manner satisfactory to the BBRS.

120.LI06.2 Suspension of Reciprocal Approval. Upon recommendation from the Division of Inspection, the BBRS shall suspend or cause to be suspended reciprocal approval for the following reasons:

1. Determination that the standards for the manufacture and inspection of such *manufactured buildings or manufactured building components* of another state or other governmental agency do not meet the objectives of 780 CMR 120.L and 780 CMR 110.R3, listed in 780 CMR 100.00, or that the standards are not being enforced to the satisfaction of the Division of Inspection or BBRS; and
2. If another state or governmental agency, or its agent, suspends or revokes said approval, the approval granted under 780 CMR 120.LI06.2 shall be suspended or revoked accordingly.

780 CMR 120.LI07 ASSURANCE INSPECTION

120.LI07.1 General. Any person or firm producing *manufactured buildings or manufactured building components* applying for certification shall agree in writing that the Division of Inspection or the BBRS has the right to conduct unannounced inspections at any reasonable time.

120.LI07.2 Responsibilities of Division of Inspection. The Division of Inspection shall carry out the following responsibilities:

1. Periodically make, or cause to be made, inspections of the entire process of the production of *manufactured buildings or manufactured building components* in order to verify the reliability of the compliance assurance program and of the approved inspection agency.
2. In addition to other on-site inspection provided for in 780 CMR 120.LI07.2, the Division of Inspection shall inspect, or cause to be inspected, certified *manufactured buildings or manufactured building components* which it determines to have been sufficiently damaged after certification to warrant such action with regard to such *manufactured buildings or manufactured building components* as is authorized hereof, or as is otherwise necessary to eliminate dangerous conditions.

Note: An inspection entailing disassembly, damage to or destruction of certified *manufactured buildings or manufactured building components* shall not be conducted except to implement the provisions of 780 CMR 120.L.

780 CMR 120.L 108 RESPONSIBILITY OF THE LOCAL ENFORCEMENT AGENCIES

120.LI08.1 Issuance of Building Permits. Upon application and in conformity with the provisions of 780 CMR, the building official shall issue building permits for installation of certified *manufactured buildings, manufactured building components or manufactured housing*.

120.LI08.1.1 Licensed Construction Supervisors and Certified Installers. A construction supervisor, duly licensed in accordance with 780 CMR 110.R5, shall, in accordance with 780 CMR 108.3.5 of the *Sixth Edition of the Massachusetts State Building Code*, act as the agent for the owner for the purpose of applying for and obtaining any and all building permits required for the field erection of all one- or two-family manufactured dwellings subject to the provisions of 780 CMR 120.L and applicable 780 CMR 110.R3.

As part of the building permit application process, the licensed construction supervisor shall submit to the building official, in writing, the name of the installer, who shall be duly certified by the manufacturer to install said manufacturer's product, and is identified as a certified installer of *manufactured buildings* (certified installer) by said manufacturer. The certified installer shall be responsible for the safe and proper placement and connection of the manufactured home units in accordance with 780 CMR 120.L, 780 CMR 110.R3 and specialized codes as listed in 780 CMR 35.00 or 780 CMR 100.00.

The licensed construction supervisor shall be responsible for the construction of the foundation system, and all pertinent site work, in accordance with 780 CMR 120.L and 780 CMR 110.R3 listed in 780 CMR 110.00. The licensed construction supervisor shall provide at least 48 hours notice to the building official before the placement and connection of such units shall begin.

120.LI08.2 Inspection. The local enforcement agency shall make the following inspections:

1. The site preparation work, including foundations, installation of any certified *manufactured buildings or manufactured building components* or approved homes; and for all utility service connections, including plumbing, electrical, gas, water and sewer; for compliance with the applicable codes.
2. Inspect all certified *manufactured buildings or manufactured building components* or approved manufactured homes upon, or promptly after, installation at the building sites to determine whether all applicable instructions or conditions have been followed. This may include tests for tightness of plumbing and mechanical systems, for malfunctions in the electrical system, and a visual inspection for obvious violations of

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780 CMR 110.R3. Destructive disassembly of certified *manufactured buildings* or *manufactured building components* or approved manufactured homes shall not be performed in order to conduct such inspections. Nondestructive disassembly may be performed only in accordance with 780 CMR 110.R3.

Note: Notification to the BBRS. When any local enforcement agency finds a violation or suspects a violation exists, said violation or suspected violation shall be reported to the BBRS in accordance with 780 CMR 110.R3.5.6.

120.LI08.3 Issuance of Certificates of Occupancy. The building official shall issue a certificate of occupancy for all certified *manufactured buildings* or approved manufactured homes that have been installed and inspected and that meet the requirements of 780 CMR.

**780 CMR 120.L 109 SUSPENSION OR
REVOCATION OF CERTIFICATION**

120.LI09.1 General. The Board shall suspend or revoke the approval of any manufactured building or manufactured building component which does not comply with the provisions of 780 CMR 120.L, 780 CMR generally or 780 CMR 110.R3.

120.LI09.2 Labels of Certification. The Division of Inspection shall remove or cause to be removed the label of certification from any such manufactured building or building component not in compliance until such time as it is brought into compliance with 780 CMR 120.L and 780 CMR 110.R3.

120.LI09.3 Notice of Suspension or Revocation. Notice shall be submitted in writing to the affected parties stating the reason for the suspension or revocation.

120.LI09.4 Appeals Procedure. All appeals from suspension or revocation shall be heard by the State Building Code Appeals Board as specified in the pertinent provisions of 780 CMR 122 or 780 CMR 5122.0

780 CMR 120.M
SWIMMING POOLS, SPAS AND HOT TUBS

780 CMR 120.M101 GENERAL

120.M101.1 General. The provisions of 780 CMR 120.M shall control the design and construction of swimming pools, spas and hot tubs.

Note 1: Public and semi-public outdoor in-ground swimming pool enclosures shall conform to the requirements of M.G.L. c. 140, § 206.

Note 2: Also see 521 CMR 19.00: Recreational Facilities.

Note 3: Also see 105 CMR 430.000 and 435.000 as such regulates swimming pool requirements.

Note 4: Installation of electrical wiring and electrical devices shall be in accordance with 527 CMR 12.00: Massachusetts Electrical Code.

Note 5. Installation of gas-fired pool heaters shall be in accordance with 248 CMR (the Massachusetts Fuel Gas and Plumbing Code).

780 CMR 120.M102 DEFINITIONS

120.M102.1 General. For the purposes of 780 CMR 120.M, the terms used shall be defined as follows and as set forth in 780 CMR 52.00.

ABOVE-GROUND/ON-GROUND POOL. See "Swimming Pool."

BARRIER. A fence, wall, building wall or combination thereof which completely surrounds the swimming pool and obstructs access to the swimming pool.

HOT TUB. See "Swimming Pool."

IN-GROUND POOL. See "Swimming Pool."

RESIDENTIAL. That which is situated on the premises of a detached one- or two-family dwelling or a one-family town-house not more than three stories in height.

SPA, NONPORTABLE. See "Swimming Pool."

SPA, PORTABLE. A nonpermanent structure intended for recreational bathing, in which all controls, water-heating and water-circulating equipment are an integral part of the product.

SWIMMING POOL. Any structure intended for swimming or recreational bathing that contains water over 24 inches (610 mm) deep. This includes in-ground, aboveground and on-ground swimming pools, hot tubs and spas.

SWIMMING POOL, INDOOR. A swimming pool which is totally contained within a structure and surrounded on all four sides by walls of said structure.

SWIMMING POOL, OUTDOOR. Any swimming pool which is not an indoor pool.

780 CMR 120.M103 SWIMMING POOLS

120.M103.1 In-ground Pools. In-ground pools shall be designed and constructed in conformance with ANSI/NSPI-5 as listed in 780 CMR 120.M107.

120.M103.2 Above-ground and On-ground Pools. Above-ground and on-ground pools shall be designed and constructed in conformance with ANSI/NSPI-4 as listed in 780 CMR 120.M107.

780 CMR 120.M104 SPAS AND HOT TUBS

120.M104.1 Permanently Installed Spas and Hot Tubs. Permanently installed spas and hot tubs shall be designed and constructed in conformance with ANSI/NSPI-3 as listed in 780 CMR 120.M107.

120.M104.2 Portable Spas and Hot Tubs. Portable spas and hot tubs shall be designed and constructed in conformance with ANSI/NSPI-6 as listed in 780 CMR 120.M107.

780 CMR 120.M105 BARRIER REQUIREMENTS

120.M105.1 Application. The provisions of 780 CMR 120.M shall control the design of barriers for residential swimming pools, spas and hot tubs. These design controls are intended to provide protection against potential drowning and near-drowning by restricting access to swimming pools, spas and hot tubs.

120.M105.2 Outdoor Swimming Pool. An outdoor swimming pool, including an in-ground, aboveground or on-ground pool, hot tub or spa shall be provided with a barrier which shall comply with the following:

1. The top of the barrier shall be at least 48 inches (1219 mm) above grade measured on the side of the barrier which faces away from the swimming pool. The maximum vertical clearance between grade and the bottom of the barrier shall be two inches (51 mm) measured on the side of the barrier which faces away from the swimming pool. Where the top of the pool structure is above grade, such as an aboveground pool, the barrier may be at ground level, such as the pool structure, or mounted on top of the pool structure. Where the barrier is mounted on top of the pool structure, the maximum vertical clearance between the top of the pool structure and the bottom of the barrier shall be four inches (102 mm).

2. Openings in the barrier shall not allow passage of a four-inch-diameter (102 mm) sphere.
3. Solid barriers which do not have openings, such as a masonry or stone wall, shall not contain indentations or protrusions except for normal construction tolerances and tooled masonry joints.
4. Where the barrier is composed of horizontal and vertical members and the distance between the tops of the horizontal members is less than 45 inches (1143 mm), the horizontal members shall be located on the swimming pool side of the fence. Spacing between vertical members shall not exceed 1.75 inches (44 mm) in width. Where there are decorative cutouts within vertical members, spacing within the cutouts shall not exceed 1.75 inches (44 mm) in width.
5. Where the barrier is composed of horizontal and vertical members and the distance between the tops of the horizontal members is 45 inches (1143 mm) or more, spacing between vertical members shall not exceed four inches (102 mm). Where there are decorative cutouts within vertical members, spacing within the cutouts shall not exceed 1.75 inches (44 mm) in width.
6. Maximum mesh size for chain link fences shall be a 2.25-inch (57 mm) square unless the fence is provided with slats fastened at the top or the bottom which reduce the openings to not more than 1.75 inches (44 mm).
7. Where the barrier is composed of dimensional members, such as a lattice fence, the maximum opening formed by the dimensional members shall not be more than 1.75 inches (44 mm).
8. Access gates shall comply with the requirements of 780 CMR 120.M105.2, Items 1 through 7, and shall be equipped to accommodate a locking device. Pedestrian access gates shall open outward away from the pool and shall be self-closing and have a self-latching device. Gates other than pedestrian access gates shall have a self-latching device. Where the release mechanism of the self-latching device is located less than 54 inches (1372 mm) from the bottom of the gate, the release mechanism and openings shall comply with the following:
 - 8.1. The release mechanism shall be located on the pool side of the gate at least three inches (76 mm) below the top of the gate, and
 - 8.2. The gate and barrier shall have no opening greater than 0.5 inch (12.7 mm) within 18 inches (457 mm) of the release mechanism.
9. Where a wall of a dwelling serves as part of the barrier one of the following conditions shall be met:
 - 9.1. The pool shall be equipped with a powered safety cover in compliance with ASTM F1346; or
 - 9.2. All doors with direct access to the pool through that wall shall be equipped with an alarm which produces an audible warning when the door and its screen, if present, are

opened. The alarm shall sound continuously for a minimum of 30 seconds immediately after the door is opened and be capable of being heard throughout the house during normal house-hold activities. The alarm shall automatically reset under all conditions. The alarm system shall be equipped with a manual means, such as touchpad or switch, to temporarily deactivate the alarm for a single opening. Such deactivation shall last for not more than 15 seconds. The deactivation switch(es) shall be located at least 54 inches (1372 mm) above the threshold of the door; or

9.3. Other means of protection, such as self-closing doors with self-latching devices, which are approved by the governing body, shall be acceptable so long as the degree of protection afforded is not less than the protection afforded by 780 CMR 120.M105.2., Item 9.1 or 9.2.

10. Where an aboveground pool structure is used as a barrier or where the barrier is mounted on top of the pool structure, and the means of access is a ladder or steps, then:

- 10.1. The ladder or steps shall be capable of being secured, locked or removed to prevent access, or

- 10.2. The ladder or steps shall be surrounded by a barrier which meets the requirements of 780 CMR 120.M105.2., Items 1 through 9. When the ladder or steps are secured, locked or removed, any opening created shall not allow the pass 120.Me of a four-inch-diameter (102 mm) sphere.

Note that for private, above ground pools:

1. *The pool wall of an outdoor, above-ground pool (with pool walls extending at least 48 inches above grade at all points along the pool), substitutes for a fence or other barrier around the pool with the exception of the ladder area of the pool.*

2. *A retractable, lockable ladder, that cannot be removed (without tools or special knowledge available to a small child), which retracts, by hinge or sliding mechanism, to 48 inches or more above the finished grade level and has provision for securing in the retracted mode with a locking device, shall be considered an acceptable alternative to the applicable required enclosure (fence or other gate barrier) of the 780 CMR 421 (6th Edition Building Code), or 780 CMR 120.M (7th Edition Building Code for One- and Two-Family Dwellings).*

3. *The retractable ladder locking/release device must be located at least 54 inches above the finished grade level in immediate vicinity of the retractable ladder or such locking/release mechanism shall be located on the pool side of the ladder (forcing*

"reach around") and located at least three inches below the top of the ladder and the ladder shall not have an opening greater than ½ inch within 18 inches of the locking/release mechanism.

Exception: Public and semi-public outdoor in-ground swimming pool enclosures shall conform to the requirements of M.G.L. c. 140, § 206.

120.M105.3 Indoor Swimming Pool. All walls surrounding an indoor swimming pool shall comply with 780 CMR 120.M105.2, Item 9.

120.M105.4 Prohibited Locations. Barriers shall be located so as to prohibit permanent structures, equipment or similar objects from being used to climb the barriers.

120.M105.5 Barrier Exceptions. Spas or hot tubs with a safety cover which complies with ASTM F 1346, as listed in 780 CMR 120.M107, shall be exempt from the provisions of 780 CMR 120.M.

780 CMR 120.M106 ENTRAPMENT PROTECTION FOR SWIMMING POOL AND SPA SUCTION OUTLETS

120.M106.1 General. Suction outlets shall be designed to produce circulation throughout the pool or spa. Single outlet systems, such as automatic vacuum cleaner systems, or other such multiple suction outlets whether isolated by valves or otherwise shall be protected against user entrapment.

Note: Also refer to 105 CMR 430.000 and 435.000.

120.M106.2 Suction Fittings. All Pool and Spa suction outlets shall be provided with a cover that conforms with ANSI/ASME A112.19.8M, or a 12I 12I drain grate or larger, or an approved channel drain system.

Exception: Surface skimmers

120.M106.3 Atmospheric Vacuum Relief System Required. All pool and spa single or multiple outlet circulation systems shall be equipped with atmospheric vacuum relief should grate covers located therein become missing or broken. Such vacuum relief systems shall include at least one approved or engineered method of the type specified herein, as follows:

1. Safety vacuum release system conforming to ASME A112.19.17, or
2. An approved gravity drainage system.

120.M106.4 Dual Drain Separation. Single or multiple pump circulation systems shall be provided with a minimum of two suction outlets of the approved type. A minimum horizontal or vertical distance of three feet shall separate such outlets. These suction outlets shall be piped so that water is drawn through them simultaneously through a vacuum relief-protected line to the pump or pumps.

120.M106.5 Pool Cleaner Fittings. Where provided, vacuum or pressure cleaner fitting(s) shall be located in an accessible position(s) at least six inches and not greater than twelve inches below the minimum operational water level or as an attachment to the skimmer(s).

780 CMR 120.M107 ABBREVIATIONS

120.M107.1 General.

ANSI—American National Standards Institute

11 West 42nd Street, New York, NY 10036

ASTM—American Society for Testing and Materials

1916 Race Street, Philadelphia, PA 19103

NSPI—National Spa and Pool Institute

2111 Eisenhower Avenue, Alexandria, VA 22314

780 CMR 120.M108 STANDARDS

120.M108.1 General.

ANSI/NSPI

ANSI/NSPI-3-99 Standard for Permanently Installed Residential Spas AG104.1

ANSI/NSPI-4-99 Standard for Above-ground/On-ground Residential Swimming Pools AG103.2

ANSI/NSPI-5-99 Standard for Residential In-ground Swimming Pools AG103.1

ANSI/NSPI-6-99 Standard for Residential Portable Spas AG104.2

ANSI/ASME A112.19.8M-1987 Suction Fittings for Use in Swimming Pools, Wading Pools, Spas, Hot Tubs and Whirlpool Bathing Appliances AG106.2

ASTM

ASTM F 1346-91 (1996) Performance Specification for Safety Covers and Labeling Requirements for All Covers for Swimming Pools, Spas and Hot Tubs AG105.2, AG105.5

ASME

ASME A112.19.17 Manufacturers Safety Vacuum Release Systems (SVRS) for Residential and Commercial Swimming Pool, Spa, Hot Tub and Wading Pool AG106.3

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NON-TEXT PAGE

780 CMR 120.N
PRIVATE SEWAGE DISPOSAL

780 CMR 120.N101 GENERAL

120.N101.1 Scope. Private sewage disposal systems shall conform to 310 CMR 15.000 (Title 5 of the State Sanitary Code).

Note: For flows over 10,000 gallons see 314 CMR 5.00.

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NON-TEXT PAGE

780 CMR 120.O
SOUND TRANSMISSION

780 CMR 120.O101 GENERAL

120.O101.1 General. Wall and floor-ceiling assemblies separating dwelling units shall provide airborne sound insulation for walls, and both airborne and impact sound insulation for floor-ceiling assemblies.

780 CMR 120.O102 AIR-BORNE SOUND

120.O102.1 General. Air-borne sound insulation for wall and floor-ceiling assemblies shall meet a Sound Transmission Class (STC) rating of 45 when tested in accordance with ASTM E 90.

**780 CMR 120.O103 STRUCTURAL-BORNE
SOUND**

120.O103.1 General. Floor/ceiling assemblies between dwelling units or between a dwelling unit and a public or service area within a structure shall have an Impact Insulation Class (IIC) rating of not less than 45 when tested in accordance with ASTM E 492.

780 120.0104 REFERENCED STANDARDS

ASTM E90-99 Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements 780 CMR 120.O102

ASTM E 492-90 (1996)e Specification for Laboratory Measurement of Impact Sound Transmission through Floor-ceiling Assemblies Using the Tapping Machine 780 CMR 120.O103

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NON-TEXT PAGE

780 CMR 120.P

STANDARD FORMS AND APPLICATIONS

(Note: These forms are unique to Massachusetts)

- State Building Code Appeals Board Application Form
- State Building Code - Code Amendment Proposal Form
- Construction Materials Safety Board Application for Approval
- State Building Code Sample Building Permit Form for One- and Two-family Dwellings
- Standard Checklist for Single- and Two-family Dwellings
- State Building Code Sample Building Permit Form for Other than One- and Two-family Dwellings
- Consumer Information Form
- Energy Conservation Mandatory Checklist for New Construction (Other than Low-rise Residential)



The Commonwealth of Massachusetts

Department of Public Safety
Board of Building Regulations and Standards
One Ashburton Place, Room 1301
Boston, Massachusetts 02108-1618

Phone (617) 727-7532

Fax (617) 227-1754

STATE BUILDING CODE APPEALS

FILING INSTRUCTIONS

Appeals are held pursuant to 801 CMR 1.02 Informal/Fair Healing Rules

BBRS\FORMS\APPEAL APPLICATION 2005

Procedures outlined on the following pages shall be followed when filing an application to appear before the Board of Building Regulations and Standards' (BBRS) Building Code Appeals Board. The Appeals Board is comprised of any three members of the BBRS. Appeals hearings are convened twice each month, generally on the first Thursday and fourth Tuesday of the month. Applications are processed on a first come, first served basis. Typically, it takes 30 to 90 days from receipt of an application to be scheduled for a hearing. Please visit our website at www.mass.gov/dps (Under "The Board of Building Regulations and Standards") for exact hearings dates and additional information about filing an appeal.

Please note that appeals hearings are intended to afford aggrieved parties with the opportunity to seek relief from the provisions of the *State Building Code* in the form of a variance or interpretation of the applicability of a particular code section. Appeals Board members are not allowed to waive code requirements in their entirety, but may consider alternative methods of complying with the intent of the code. Appeals Board members are not arbiters; rather they are professional persons representing a cross section of the building design, construction and regulatory industries who are educated in code matters. Board members will judge testimony and materials presented at a hearing based on technical merits in relation to code requirements. Appeals Board members do not have any authority to rule on zoning issues (land use issues).

Zoning requirements differ in each community. Therefore, appeals relating to land use should be directed to the Zoning Appeals Board in the city or town in which the property is located.

In order to assist with understanding the process, we have provided answers to *Frequently Asked Questions* relative to appeals procedures below.

Frequently Asked Questions About the Appeals Process

Question: What is the overall intent of the code?

Answer: The building code sets minimum standards for the design and construction of all buildings and structures in the commonwealth. The intent is to ensure that all citizens are afforded a consistent level of safety in all buildings in which they visit, live or work. A code user may choose to exceed requirements of the code, but may not design or construct to a lesser standard.

Question: What if I am not able to abide by the provisions of the code verbatim, are appeals procedures available?

Answer: The BBRS maintains an active Building Code Appeals Board which meets at least twice each month. In order to file an appeal with the State Board, a notice of violation must first be issued by the municipal or state building official charged with the enforcement of the code. This notice identifies the subject matter to be addressed at the appeal.

Once an appeal application is stamped as received by the BBRS, a stay of proceedings is enacted. This stay prevents a building official from taking further action with regard to the subject of the appeal. Also, it allows the applicant to continue to work on the project. However, please be aware that the work is continued at the applicant's risk. A stay of proceedings may not be applicable if an inspector has issued a *stop work order*.

Among other things, Appeals Board members may allow variances to provisions of the code or may offer interpretations to clarify disputes relative to a code provision. However, it is not the intent to simply waive code provisions in disregard of the public safety intent. Therefore, an applicant must demonstrate first a need for variance (if this is the intended relief) and then identify how he/she will achieve a comparable level of safety for building occupants. An applicant should always keep in mind that the code is a public safety document and that arguments relating to an appeal case should focus on issues of safety and compliance with the intent of the code; arguments should not focus on monetary savings for a project, at least not entirely.

Generally, it takes about 30 to 90 days after receipt of an application for a case to be heard. Although most cases are decided on the day of the hearing. Board members have 30 days following the hearing to issue a written decision. Technically, the decision is not finalized until the written decision is issued. Depending on complexity, cases may at times be continued and/or taken under advisement for determination at a later date.

If an appellant or other party is aggrieved by the Board's determination, he/she may request a reconsideration of the decision. Reconsideration requests must be filed in writing within ten days of receiving the written decision. It is important to note that a reconsideration may only be considered on the basis of *new evidence*. Reconsiderations are not intended simply as a second chance to review the case. Reconsiderations are reserved for those rare instances where all facts relating to a matter may, for reason or other, not have been suitably brought forward and examined during the hearing. Reconsideration requests are required to be reviewed by Board members who originally heard the case. If a majority of Board members agree that new evidence exists, a new hearing will be scheduled. Otherwise, aggrieved parties may appeal a decision of the Board to a court of law.

Appeals procedures follow the informal/fair hearings procedures as defined in 801 CMR 1.02. Interested parties may retrieve this document by visiting www.state.ma.us/dala/801cmr.htm.

Question: Are there other reasons for filing an appeal?

Answer: An appeal may also be filed for a building official's *failure to act* on a matter. The code allows a period of 30 days for a building official to review and act on an application for permit. Technically, if a response is not received within this period an appeal may be filed on the 31st day. However, such quick action is not recommended. Like most people, building officials can get behind on their workload. If the 30 day period passes without a response, call the building official, documenting the day and time, to see if a response is forthcoming. If a response is not received via phone, try corresponding in writing, by certified mail if so desired. If these methods fail, an appeal may be filed to address the issue of the inspector's failure to act.

Procedures for Filing An Appeals Application

Please follow the instructions below when completing an Appeals Application.

1. Unless filing for a *failure to act*, the appellant must be in receipt of a denial letter from the municipal or state building official as required in Chapter 1 of the State Building Code. An appeal must be filed *within 45 days* of the date of the letter of denial. An appeal may be filed either with the local *Building Code Appeals Board*, if one has been established, or directly with the State Building Code Appeals Board. Also, an appellant may file an appeal relative to a building official's *failure to act* on his/her permit application as provided for in Chapter 1 of the State Building Code (A letter of denial is not required when filing for *failure to act*).

2. Two documents are required to be completed by the appellant or his/her representative when filing an appeal. (Each is part of this document.)

the *Appeal Application Form* (3 pages)
and the *Service Notice* (1 page).

The *Service Notice*, which gives notice to the building official that an appeal is being filed, should include the date appearing and the name and address of the building official under the section titled, "PERSON/AGENCY SERVED". The *Method of Service* should list one of the following procedures as set forth in Chapter I of the State Building Code for serving notice to the appropriate building inspector.

- A. Personally; or
- B. Registered or Certified Mail, return receipt requested; or
- C. By any person authorized to serve civil process.

The *Date of Service* is the date when a copy of the appeal is delivered or mailed to the building official or other party entitled on the application.

The *Service Notice* must be signed by the appellant or his/her representative and the signature must be notarized.

The *Appeal Application Form* (2 pages) *must be completed in total*. The application will be reviewed for completeness prior to a hearing being scheduled. Applications determined to be incomplete will be returned to the applicant for correction. Questions relating to completing the application should be directed to your local building department or this office. Questions relating to the process may be directed to the Appeals Board Hearings Coordinator at (617) 727-3200, extension 25209.

3. *One* complete copy of the appeal filing, including the *original Service Notice*, must be delivered to the noted Building Official or the official entitled. *Four* complete copies of the appeal filing, including the original plus three copies of the *Appeal Application* form, *four* copies of the *Service Notice* and *four* copies of the denial letter, together with a check for **\$150.00** (filing fee) payable to the Commonwealth of Massachusetts must be submitted to this office, if the appeal is made directly to the State Building Code Appeals Board. (Fee requirements for filing before a local Building Code Appeals Board may differ from the fees prescribed for submission to the State Building Code Appeals Board. Please check with municipal building official for these fees.).

ALL CASES WILL BE HEARD ON THE SCHEDULED DATE. POSTPONEMENTS MAY ONLY BE CONSIDERED IN EXTREME SITUATIONS WHERE SUFFICIENT NOTICE HAS BEEN PROVIDED.



The Commonwealth of Massachusetts

Department of Public Safety
 Board of Building Regulations and Standards
 One Ashburton Place, Room 1301
 Boston, Massachusetts 02108-1618
 Phone (617) 727-7532
 Fax (617) 227-1754

STATE BUILDING CODE APPEAL APPLICATION FORM

DOCKET NUMBER (State Use Only)		DATE	
-----------------------------------	--	------	--

The undersigned hereby appeals to the State Board of Building Regulations and Standards from the decision of the following person. (Please fill-in the name of the appropriate municipal or state building inspector or other authority. Also indicate if this is a request for a *hearing de novo* (new hearing) relative to a decision of a municipal appeals board.)

Building Official from the City/Town of:	
Board of Appeals from the City/Town of: (Request for <i>hearing de novo</i>)	
State Building Official:	
Other:	

Please mark the appropriate box indicating the requested action to be considered by the Appeals Board members. (More than one box may be marked.)

Variance		Order		Direction	
Interpretation		Failure to Act		Other	
STATE USE ONLY					
Fee Received					
Check Number					
Received By					

(This section must be completed or the application will be returned.)

Has the building or structure been the subject of an appeal by this or any other appeals board previous to this filing?

No ☐ Yes ☐ If yes, please indicate the date of the previous appeal, whether the matter was heard before a local or state appeals board, the code section that was at issue, and the specifications of the decision (i.e. a variance was granted/not granted).

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THE MASSACHUSETTS STATE BUILDING CODE

Please take care to submit all *written* supporting documentation with this application to allow time for review. However, Board members reserve the right to continue proceedings if such material warrant extensive review.

Please provide a brief description of the desired relief below. Additional information may be attached if space is not sufficient. *All appropriate code sections that are subject to appeal must be identified in the description.*

Please complete the following section completely and accurately.

Name of Appellant:		Representing:	
Address for Service:			
Telephone Number:		Fax Number:	
Address of Subject Property (if different from service address):			
What is appellant's connection to subject property?			

Signature of Appellant and/or Representative

Please print name legibly

Please return applications to:
Program Manager, Board of Appeals
Board of Building Regulations and Standards - One Ashburton Place, Boston, MA 1301
Boston, MA 02108-2618

DESCRIPTION OF BUILDING OR STRUCTURE RELATIVE TO THE MASSACHUSETTS STATE BUILDING CODE (780 CMR 7th EDITION): (Check as appropriate)

Do not complete the tables below for one and two family dwellings. Proceed to section entitled "Brief Description of the proposed Work".

DESCRIPTION OF PROPOSED WORK (check all applicable)
--

New Construction	Existing Building	Repair(s)	Alteration(s)	Addition
Accessory Bldg.	Demolition	Other Specify: _____		
Brief Description of Proposed Work:				

USE GROUP AND CONSTRUCTION TYPE
--

USE GROUP (Circle appropriate Use Group)			CONSTRUCTION TYPE	
A Assembly	A-1	A-2	A-3	1A
	A-4	A-5		1B
B Business				2A
E Educational				2B
F Factory	F-1	F-2		2C
H High Hazard				3A
I Institutional	I-1	I-2	I-3	3B
M Mercantile				4
R Residential	R-1	R-2	R-3	5A
S Storage	S-1	S-2		5B
U Utility	Specify: _____			
M Mixed Use	Specify: _____			
S Special Use	Specify: _____			

COMPLETE THIS SECTION IF EXISTING BUILDING UNDERGOING RENOVATIONS, ADDITIONS AND/OR CHANGE IN USE

Existing Use Group: _____	Proposed Use Group: _____
Existing Hazard Index (780 CMR 34): _____	Proposed Hazard Index (780 CMR 34): _____

BUILDING HEIGHT AND AREA

BUILDING AREA	Existing (if applicable)	Proposed
Number of Floors or stories include basement levels		
Floor Area per Floor (sf)		
Total Area (sf)		
Total Height (ft)		

Brief Description of the Proposed Work:

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THE MASSACHUSETTS STATE BUILDING CODE

STATE BUILDING CODE APPEALS BOARD
Service Notice

I, _____, as _____ for the
Appellant/Petitioner _____ in an appeal filed with the
State Building Code Appeals Board on _____, 20 _____

HEREBY SWEAR UNDER THE PAINS AND PENALTIES OF PERJURY THAT IN ACCORDANCE
WITH THE PROCEDURES ADOPTED BY THE STATE BOARD OF BUILDING REGULATIONS AND
STANDARDS AND SECTION 122.3.1 OF THE STATE BUILDING CODE, I SERVED OR CAUSED TO
BE SERVED, A COPY OF THIS APPEAL APPLICATION ON THE FOLLOWING PERSON(S) IN THE
FOLLOWING MANNER:

NAME AND ADDRESS OF PERSON OR AGENCY SERVED		METHOD OF SERVICE	DATE OF SERVICE
1			
2			
3			

Signature: Appellant/Petitioner _____

On the _____ Day of _____ 20 _____, PERSONALLY APPEARED

B E F O R E M E T H E A B O V E N A M E D

(Type or Print the Name of the Appellant)

AND ACKNOWLEDGED AND SWORE THE ABOVE STATEMENTS TO BE TRUE.

NOTARY PUBLIC

MY COMMISSION EXPIRES



Commonwealth of Massachusetts
Construction Materials Safety Board (CMSB)
Application for Approval

This form shall be used to apply to the Construction Materials Safety Board for approval of a product, material or methodology, which is not specifically defined by the Massachusetts State Building Code.

Application Number: _____ **Date of Application** _____

(State Use Only)

1.0 Company Name: _____
Address: _____
Telephone No.: _____
E-mail Address: _____
Contact Person and Title: _____

2.0 Name of product/material/methodology
(For products and/or materials, provide all model numbers, types, sizes, etc., for which
Massachusetts approval is sought.

3.0 Description and intended use of product/material/methodology

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- 4.0 If possible, identify section(s) of the Massachusetts State Building Code for which product/material/methodology approval is sought.

- 5.0 Information required for "end-user" of product/material/methodology (include any structural egress, fire safety, light or ventilation, energy conservation or other requirements and any limitations).

- 6.0 Instructions to building officials required to approve plans and inspect construction sites where applicable products/materials/methodology are utilized.

- 7.0 National Model Building Code Research Report Number(s) in force, if any (append actual reports to this application).

<u>ORGANIZATION</u>	<u>EVALUATION REPORT NO.</u>	<u>EVALUATION REPORT ISSUE DATE</u>
<u>BOCA</u>		
<u>ICBO</u>		
<u>SBCCI</u>		
<u>CABO</u>		
<u>ICC</u>		
<u>OTHER</u>		

8.0 Testing Laboratory Test Reports, if any (append actual reports to this application).

<u>ORGANIZATION</u>	<u>TEST REPORT NO.</u>	<u>TEST REPORT ISSUE DATE</u>
<u>F.M.</u>	_____	_____
<u>N.L.</u>	_____	_____
<u>W.H.</u>	_____	_____
<u>OTHER</u>	_____	_____

9.0 Current State/County/Municipality Approvals

<u>JURISDICTION</u>	<u>APPROVAL NUMBER</u>	<u>APPROVAL DATE</u>
_____	_____	_____
_____	_____	_____
_____	_____	_____

10.0 Description and inclusion of technical information submitted to support request for approval (append actual technical information to this application)

11.0 Description and inclusion of technical information submitted to support request for approval (append actual technical information to this application).

12.0

AUTHORIZED SIGNATURE

PRINT OR TYPE AUTHORIZED NAME HERE

TITLE: _____

SUBMISSION DATE: _____

780 CMR: STATE BOARD OF BUILDING REGULATIONS AND STANDARDS
THE MASSACHUSETTS STATE BUILDING CODE

The Commonwealth of Massachusetts State Board of Building Regulations and Standards Massachusetts State Building Code For One- and Two-family Dwellings				FOR MUNICIPALITY USE	
APPLICATION TO CONSTRUCT, REPAIR, RENOVATE OR DEMOLISH A ONE OR TWO FAMILY DWELLING					
This Section For Official Use Only					
Building Permit Number: _____			Date Issued: _____		
Signature: _____			Date: _____		
Building Commissioner/Inspector of Buildings					
SECTION 1 - SITE INFORMATION					
1.1 Property Address _____ _____			1.2 Assessors Map & Parcel Number: _____ Map Number _____ Parcel Number _____		
1.3 Zoning Information: Zoning District _____ Proposed Use _____			1.4 Property Dimensions Lot Area (sf) _____ Frontage (ft) _____		
1.5 Building Setbacks (ft)					
Front Yard		Side Yards		Rear Yard	
Required	Provided	Required	Provided	Required	Provided
		/	/		
1.6 Water Supply (M.G.L. c. 40, § 54) Public ☐ Private ☐		1.7 Flood Zone Information: Zone: _____ Outside Flood Zone ☐		1.8 Sewage Disposal System: Municipal ☐ On site disposal system ☐	
SECTION 2 - PROPERTY OWNERSHIP/AUTHORIZED AGENT					
2.1 Owner of Record:					
Name (Print) _____			Address for Service: _____		
Signature _____			Telephone _____		
2.2 Authorized Agent:					
Name (Print) _____			Address for Service: _____		
Signature _____			Telephone _____		
SECTION 3 - CONSTRUCTION SERVICES					
3.1 Licensed Construction Supervisor: Licensed Construction Supervisor: _____ Address: _____ Signature _____ Telephone _____				Not Applicable ☐ License Number _____ Expiration Date _____	
3.2 Registered Home Improvement Contractor: Company Name _____ Address: _____ Signature _____ Telephone _____				Not Applicable ☐ Registration Number _____ Expiration Date _____	

Construction Checklist**Single- & Two Family Dwellings**

If required by the building official, this form shall be submitted at the completion of the work, prior to the issuance of a certificate of occupancy or completion, by the licensed construction supervisor, registered professional or homeowner (responsible party), as applicable, the municipal and/or state building official in verification that, to the best of his/her knowledge, the work has been executed in accordance with the provisions of the applicable state building code (code) and reference standards. The date shall indicate the date on which the responsible party viewed the building activity to ensure compliance with the code and/or reference standards. This date may or may not correspond to the date on which the activity was inspected for compliance by the municipal and/or state building official.

Activity	Date	Note any deficiencies that were discovered (if any) and corrective action taken to ensure compliance with the code and/or reference standards
Foundation		
a. Location/excavation ¹		
b. Preparation of bearing soil		
c. Placement of forms/reinforcing		
d. Placement of Concrete		
e. Setting weather protection methods		
f. Installation of water/dampproofing		
g. Placement of backfill		
Structural Frame²		
a. Floor		
b. Walls		
c. Roof/ceilings		
d. Masonry or other structural system		
Energy Conservation		
a. Insulation/vapor and air infiltration barriers		
b. NFRC rated window		
c. HVAC equipment with proper efficiencies		
Fire Protection		
a. Smoke		
b. Heat		
c. Carbon Monoxide		
d. Other		
Special Construction		
a. Chimneys		
b. Retaining Walls		
c. Other ³		

1. If encountered in excavating for foundation placement, the responsible party shall report the presence of groundwater to the building official and shall submit a report detailing methods of remediation.
2. Frame shall include the installation of all joists, trusses and other structural members and sheathing materials to verify size, species and grad, spacing and attachment methods. The responsible party shall ensure that any cutting or notching of structural members is performed in accordance with the requirements of this code.
3. The building official may require the responsible party to be present on site at other points during the construction, reconstruction, alteration, removal or demolition work as he/she deems appropriate.

[illegible]

	The Commonwealth of Massachusetts State Board of Building Regulations and Standards Massachusetts State Building Code	FOR MUNICIPALITY USE
APPLICATION TO CONSTRUCT, REPAIR, RENOVATE, CHANGE THE USE OR OCCUPANCY OF, OR DEMOLISH ANY BUILDING OTHER THAN A ONE OR TWO FAMILY DWELLING		

This Section For Official Use Only	
Building Permit Number: _____	Date Issued: _____
Signature: _____ Building Commissioner/Inspector of Buildings Date	

SECTION 1 - SITE INFORMATION					
1.1 Property Address _____ _____			1.2 Assessors Map & Parcel Number: _____ Map Number Parcel Number		
1.3 Zoning Information: Zoning District _____ Proposed Use _____			1.4 Property Dimensions: Lot Area (sf) _____ Frontage (ft) _____		
1.5 Building Setbacks (ft)					
Front Yard		Side Yards		Rear Yard	
Required	Provided	Required	Provided	Required	Provided
		/	/		
1.6 Water Supply (M.G.L. c. 40, § 5A) Public ☐ Private ☐		1.7 Flood Zone Information: Zone: _____ Outside Flood Zone ☐		1.8 Sewage Disposal System: Municipal ☐ On site disposal system ☐	

SECTION 2 - PROPERTY OWNERSHIP/AUTHORIZED AGENT	
2.1 Owner of Record: Name (Print) _____ Signature _____ Telephone _____ Address: _____ _____ _____	
2.2 Authorized Agent: Name (Print) _____ Signature _____ Telephone _____ Address: _____ _____ _____	

SECTION 3 - CONSTRUCTION SERVICES FOR PROJECTS LESS THAN 35,000 CUBIC FEET OF ENCLOSED SPACE	
3.1 Licensed Construction Supervisor: Licensed Construction Supervisor: _____ Address _____ Signature _____ Telephone _____	Not Applicable ☐ License Number _____ Expiration Date _____
3.2 Registered Home Improvement Contractor: Company Name _____ Address _____ Signature _____ Telephone _____	Not Applicable ☐ Registration Number _____ Expiration Date _____

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SECTION 4 - WORKERS' COMPENSATION INSURANCE AFFIDAVIT (M.G.L. c. 152 § 25C(6))

Workers Compensation Insurance affidavit must be completed and submitted with this application. Failure to provide this affidavit result in the denial of the issuance of the building permit.

Signed Affidavit Attached Yes....☐ No.....☐

SECTION 5- PROFESSIONAL DESIGN AND CONSTRUCTION SERVICES - FOR BUILDINGS AND STRUCTURES SUBJECT TO CONSTRUCTION CONTROL PURSUANT TO 780 CMR 116 (CONTAINING MORE THAN 35,000 C.F. OF ENCLOSED SPACE)

5.1 Registered Architect:

Name (Registrant):	Not Applicable ☐
Address	Registration Number
Signature	Expiration Date
Telephone	

5.2 Registered Professional Engineer(s):

Name	Area of Responsibility
Address	Registration Number
Signature	Expiration Date
Telephone	
Name	Area of Responsibility
Address	Registration Number
Signature	Expiration Date
Telephone	
Name	Area of Responsibility
Address	Registration Number
Signature	Expiration Date
Telephone	
Name	Area of Responsibility
Address	Registration Number
Signature	Expiration Date
Telephone	

5.3 General Contractor

Company Name:	Not Applicable ☐
Responsible In Charge of Construction	
Address	
Signature	
Telephone	

SECTION 6 - DESCRIPTION OF PROPOSED WORK (check all applicable)				
New Construction ☐	Existing Building ☐	Repair(s) ☐	Alteration(s) ☐	Addition ☐
Accessory Bldg. ☐	Demolition ☐	Other ☐ Specify: _____		
Brief Description of Proposed Work: 				

SECTION 7 - USE GROUP AND CONSTRUCTION TYPE									
USE GROUP (Check as applicable)						CONSTRUCTION TYPE			
A Assembly	☐	A-1	☐	A-2	☐	A-3	☐	1A	☐
		A-4	☐	A-5	☐			1B	☐
B Business	☐							2A	☐
E Educational	☐							2B	☐
F Factory	☐	F-1	☐	F-2	☐			2C	☐
H High Hazard	☐							3A	☐
I Institutional	☐	I-1	☐	I-2	☐	I-3	☐	3B	☐
M Mercantile	☐							4	☐
R Residential	☐	R-1	☐	R-2	☐	R-3	☐	5A	☐
S Storage	☐	S-1	☐	S-2	☐			5B	☐
U Utility	☐	Specify: _____							
M Mixed Use	☐	Specify: _____							
S Special Use	☐	Specify: _____							

COMPLETE THIS SECTION IF EXISTING BUILDING UNDERGOING RENOVATIONS, ADDITIONS AND/OR CHANGE IN USE

Existing Use Group: _____	Proposed Use Group: _____
Existing Hazard Index 780 CMR 34): _____	Proposed Hazard Index 780 CMR 34): _____

SECTION 8 BUILDING HEIGHT AND AREA		
BUILDING AREA	Existing (if applicable)	Proposed
Number of Floors or stories include basement levels		
Floor Area per Floor (sf)		
Total Area (sf)		
Total Height (ft)		

SECTION 9 - STRUCTURAL PEER REVIEW (780 CMR 110.11)	
Independent Structural Engineering Structural Peer Review Required	Yes. ☐ ... No. ☐

SECTION 10a - OWNER AUTHORIZATION - TO BE COMPLETED WHEN OWNERS AGENT OR CONTRACTOR APPLIES FOR BUILDING PERMIT	
I, _____, as Owner of the subject property hereby authorize _____ to act on my behalf all matters relative to work authorized by this building permit application.	
Signature of Owner _____	Date _____

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SECTION 10b - OWNER/AUTHORIZED AGENT DECLARATION

I, _____, as Owner/Authorized Agent hereby declare that the statements and information on the foregoing application are true and accurate, to the best of my knowledge and belief. Signed under the pains and penalties of perjury.

Print Name _____

Signature of Owner/Agent _____

Date _____

SECTION 11 - ESTIMATED CONSTRUCTION COSTS

Item	Estimated Cost (Dollars) to be completed by permit applicant	Official Use Only	
1. Building		(a) Building Permit Fee Multiplier	
2. Electrical		(b) Estimated Total Cost of Construction from (6)	
3. Plumbing		Building Permit Fee (a) x (b)	
4. Mechanical (HVAC)			
5. Fire Protection			
6. Total = (1 + 2 + 3 + 4 + 5)		Check Number	



CONSUMER INFORMATION FORM - "SUNROOMS"

Massachusetts State Building Code (780 CMR 6101.3.2.2)

The Massachusetts State Building Code (780 CMR) includes provisions to ensure that houses and house additions meet energy efficiency standards. This supplemental CONSUMER INFORMATION FORM is to be filed as part of the building permit application when a builder/contractor or homeowner, constructing/installing a house addition with very large percentage of glass to opaque wall, seeks to utilize a special energy conservation exemption option for "sunroom" additions to an existing house (780 CMR, 6101.3.2.2). This FORM is not intended to prevent a homeowner from selecting a "sunroom" of any size, configuration, orientation, form of construction or percent glazing, but rather is only intended to assist homeowners in becoming aware of some of the important energy conservation and year-round comfort considerations involved in selecting and utilizing a "sunroom" addition.

The connection of "sunroom" structures to residential buildings may create comfort and energy consumption issues due to uncontrolled solar gain or uncontrolled radiation cooling of the main house. In the selection and construction/installation of "sunrooms", included below is a non-required, open-ended list of product and design considerations that a homeowner may wish to consider before actually constructing/installing a "sunroom". It is recommended that consumers carefully review these options with their designer, builder, or contractor, in order to minimize potential energy consumption and/or house discomfort issues. In addition, the qualifications and reputation of the company or individuals to be hired are important considerations.

PRODUCT AND DESIGN CONSIDERATIONS RELATED TO "SUNROOMS"

- Solar Orientation and Natural Shading
- Type of Glazing
 - Insulating value
 - Solar heat gain
 - Frame materials
 - Glazing to frame sealing and gasketing materials/ seal durability and/or weather tightness of the sunroom
- Adequate ventilation - Operable windows and fans
- Applied Shading Systems
- Insulation level in floors, walls, and ceilings
- Possible Sunroom isolation from the main house via a wall and/or door or slider
- Heating and Cooling Methods: Efficiency, Zoning and Controls

Homeowner Acknowledgment

The Massachusetts State Building Code, 780 CMR 6101.3.2.2, requires that the actual property owner (not the owner's agent or representative) acknowledge receipt of this CONSUMER INFORMATION FORM prior to issuance of a Building Permit for a project that includes "sunroom" additions to an existing residential building. In accordance with this requirement, the undersigned hereby acknowledges that she/he has read the information in this document concerning sunroom comfort and energy conservation.

Signature of Actual Building Owner

Date

Print Name

Address of Permitted Project

Owner Address (if different than project location)

Owner's telephone number

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ENERGY CONSERVATION MANDATORY CHECKLIST FOR NEW CONSTRUCTION
(OTHER THAN LOW-RISE RESIDENTIAL) 780 CMR, 1301.8.1



Owner/Agent Name: _____ Phone: _____
Owner/Agent Address: _____
City/State/Zip: _____
Project Name: _____
Site Address: _____ City/Town: _____
Applicant's Name: _____ Signature: _____
Applicant's Phone: _____ Date of Application: _____

I. Envelope Compliance Option (check ONE)

- ☐ **Trade-Off** (1304.5) - Attach software Compliance Report (COMcheck-EZ)
☐ **Appendix J** (1301.2 - For buildings up to 10,000 sf only) - Attach Appendix J compliance documentation
☐ **Systems Analysis** (1309) - Attach Registered Architect's or Engineer's report

☐ **Prescriptive** (1304.2) - Complete this section, and attach copy of applicable Table (1304.2.1 through 13.4.2.12)

Climate Zone (from Table 1303.1)

☐ Zone 12a

☐ Zone 13a

☐ Zone 14a

a. Gross above-grade wall area _____ sq.ft.

b. Total window & glass door area _____ sq.ft.

c. Glazing % (100 x b÷a) _____ % Table # utilized: _____

II. HVAC (check ONE)

- ☐ Simple Systems & Equipment (1305.2) ☐ Complex Systems & Equipment (1305.3)
☐ Systems Analysis (1309) - Attach Registered Architect's or Engineer's report

III. Lighting (check ONE)

- ☐ Building Area Method (1308.6.2.1)
☐ Space-by-Space Method (1308.6.2.2) } Attach Compliance Documentation (COMcheck-EZ or other)
☐ Systems Analysis (1309) - Attach Registered Architect's or Engineer's report

IV. Approval & Acceptance Construction Documents (1301.8.4.1)

Attach a narrative report describing the HVAC, Lighting, and Electric Distribution systems, including:

For Official Use ONLY:

- | | | |
|--|--------------------------|---|
| Building Official
check off completed
sections of report | ☐ | 1. Design Intent |
| | ☐ | 2. Basis of Design |
| | ☐ | 3. Sequence of operation / systems interaction |
| | ☐ | 4. Description of the systems (capacities, etc.) |
| | ☐ | 5. Testing requirements / criteria acceptance |
| | ☐ | 6. Requirement for submittal of operation manuals and maintenance manuals |
| | ☐ | 7. Requirement for submittal of record drawings and control documents |

This Side For Use by Building Department Only

Official's Name: _____ Title: _____

I. Plans Review

Date Application Received: _____

☐ Complete Narrative Report Received (1301.8.4.1)☐ Design and Specification Documents prepared by legally recognized professional (1301.8.4.3)Application is: Approved ☐ Date: _____ Signature: _____Denied ☐ Date: _____

Reason(s) for Denial: (provide additional details as needed on separate sheet)

II. Acceptance (1301.8.4.4)

- ☐ Successful system tests witnessed by Building Official, **OR** ☐ satisfactory test report received (check one)
- ☐ Certification by Registered Professional (per 780 CMR 116.2) that systems are installed in accordance with construction documents
- ☐ Confirmation by owner (or their authorized representative) that they have received record drawings, reviewed for reasonable accuracy
- ☐ Confirmation by owner (or their authorized representative) that they have received reports, controls documentation, operations manual(s), maintenance manual(s), and other documents specified in 1301.8.4.1

Building Official's Signature: _____

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AWC Guide to Wood Construction in High Wind Areas: 110 mph Wind Zone
Massachusetts Checklist for Compliance (780 CMR 5301.2.1.1)¹

☒ Check
Compliance

1.1 SCOPE

Wind Speed (3-sec. gust) 110 mph ____
Wind Exposure Category B ____

1.2 APPLICABILITY

Number of Stories (a roof which exceeds 8 in 12 slope shall be considered a story)
..... stories $\leq$ 2 stories ____
Roof Pitch (Fig 2) $\leq$ 12:12 ____
Mean Roof Height (Fig 2) ft $\leq$ 33' ____
Building Width, W (Fig 3) ft $\leq$ 80' ____
Building Length, L (Fig 3) ft $\leq$ 80' ____
Building Aspect Ratio (L/W) (Fig 4) $\leq$ 3:1 ____
Nominal Height of Tallest Opening² (Fig 4) $\leq$ 6'8" ____

1.3 FRAMING CONNECTIONS

General compliance with framing connections ... (Table 2) ____

2.1 FOUNDATION

Foundation Walls meeting requirements of 780 CMR 5404.1
Concrete ____
Concrete Masonry ____

2.2 ANCHORAGE TO FOUNDATION^{1,3}

$\frac{5}{8}$ " Anchor Bolts imbedded or $\frac{5}{8}$ " Proprietary Mechanical Anchors as an alternative in concrete only
Bolt Spacing – general (Table 4) in. ____
Bolt Spacing from end/joint of plate (Fig 5) in. $\leq$ 6" – 12" ____
Bolt Embedment – concrete (Fig 5) in. $\geq$ 7" ____
Bolt Embedment – masonry (Fig 5) in. $\geq$ 15" ____
Plate Washer (Fig 5) $\geq$ 3" x 3" x $\frac{1}{4}$ " ____

3.1 FLOORS

Floor framing member spans checked (per 780 CMR 55.00) ____
Maximum Floor Opening Dimension (Fig 6) ft $\leq$ 12' ____
Full Height Wall Studs at Floor Openings less than 2' from Exterior Wall (Fig 6) ____
Maximum Floor Joist Setbacks
Supporting Loadbearing Walls or Shearwall . (Fig 7) ft $\leq$ d ____
Maximum Cantilevered Floor Joists
Supporting Loadbearing Walls or Shearwall . (Fig 8) ft $\leq$ d ____
Floor Bracing at Endwalls (Fig 9) ____
Floor Sheathing Type (per 780 CMR 55.00) ____
Floor Sheathing Thickness (per 780 CMR 55.00) in. ____
Floor Sheathing Fastening (Table 2) ____ d nails at ____ in edge / ____ in field ____

4.1 WALLS

Wall Height
Loadbearing walls (Fig 10 and Table 5) ft $\leq$ 10' ____
Non-Loadbearing walls (Fig 10 and Table 5) ft $\leq$ 20' ____
Wall Stud Spacing (Fig 10 and Table 5) in. $\leq$ 24" o.c. ____
Wall Story Offsets (Figs 7 & 8) ft $\leq$ d ____

4.2 EXTERIOR WALLS³

Wood Studs
Loadbearing walls (Table 5) 2x ____ - ____ ft ____ in. ____
Non-Loadbearing walls (Table 5) 2x ____ - ____ ft ____ in. ____
Gable End Wall Bracing¹
Full Height Endwall Studs (Fig 10) ____
WSP Attic Floor Length (Fig 11) ft $\geq$ W/3 ____
Gypsum Ceiling Length (if WSP not used) (Fig 11) ft $\geq$ 0.9W ____
and 2 x 4 Continuous Lateral Brace @ 6 ft. o.c. ... (Fig 11) ____
or 1 x 3 ceiling furring strips @ 16" spacing min. with 2 x 4 blocking @ 4 ft. spacing in end
joist or truss bays ____
Double Top Plate
Splice Length (Fig 13 and Table 6) ft ____
Splice Connection (no. of 16d common nails)(Table 6) ____

Loadbearing Wall Connections	
Lateral (no. of 16d common nails) (Tables 7)	_____
Non-Loadbearing Wall Connections	
Lateral (no. of 16d common nails) (Table 8)	_____
Load Bearing Wall Openings (record largest opening but check all openings for compliance to Table 9)	
Header Spans (Table 9)	_____ ft _____ in. $\leq$ 11'
Sill Plate Spans (Table 9)	_____ ft _____ in. $\leq$ 11'
Full Height Studs (no. of studs) (Table 9)	_____
Non-Load Bearing Wall Openings (record largest opening but check all openings for compliance to Table 9)	
Header Spans (Table 9)	_____ ft _____ in. $\leq$ 12'
Sill Plate Spans (Table 9)	_____ ft _____ in. $\leq$ 12'
Full Height Studs (no. of studs) (Table 9)	_____
Exterior Wall Sheathing to Resist Uplift and Shear Simultaneously ⁴	
Minimum Building Dimension, W	
Nominal Height of Tallest Opening ²	_____ $\leq$ 6'8"
Sheathing Type (note 4)	_____
Edge Nail Spacing (Table 10 or note 4 if less)	_____ in.
Field Nail Spacing (Table 10)	_____ in.
Shear Connection (no. of 16d common nails) (Table 10)	_____
Percent Full-Height Sheathing (Table 10)	_____ %
5% Additional Sheathing for Wall with Opening > 6'8" (Design Concepts)	_____
Maximum Building Dimension, L	
Nominal Height of Tallest Opening ²	_____ $\leq$ 6'8"
Sheathing Type (note 4)	_____
Edge Nail Spacing (Table 11 or note 4 if less)	_____ in.
Field Nail Spacing (Table 11)	_____ in.
Shear Connection (no. of 16d common nails) (Table 11)	_____
Percent Full-Height Sheathing (Table 11)	_____ %
5% Additional Sheathing for Wall with Opening > 6'8" (Design Concepts)	_____
Wall Cladding	
Rated for Wind Speed?	_____

5.1 ROOFS

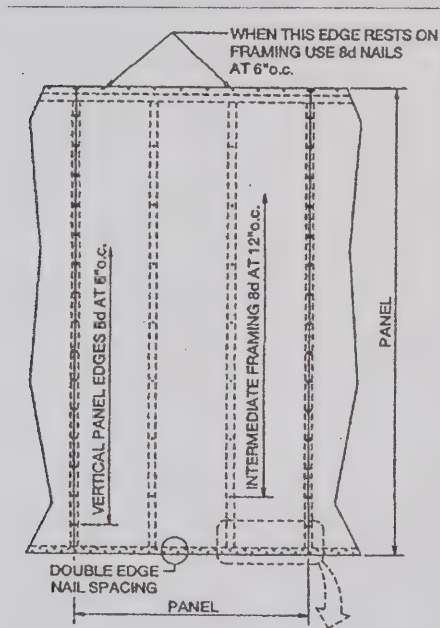
Roof framing member spans checked? (For Rafters use AWC Span Tool, see BBRs Website)	_____
Roof Overhang (Figure 19)	_____ ft $\leq$ smaller of 2' or L/3
Truss or Rafter Connections at Loadbearing Walls	
Proprietary Connectors	
Uplift (Table 12)	U= _____ plf
Lateral (Table 12)	L= _____ plf
Shear (Table 12)	S= _____ plf
Ridge Strap Connections, if collar ties not used per page 21 (Table 13)	T= _____ plf
Gable Rake Outlooker (Figure 20)	_____ ft $\leq$ smaller of 2' or L/2
Truss or Rafter Connections at Non-Loadbearing Walls	
Proprietary Connectors	
Uplift (Table 14)	U= _____ lb.
Lateral (no. of 16d common nails) (Table 14)	L= _____ lb.
Roof Sheathing Type (per 780 CMR 58.00 and 59.00)	_____
Roof Sheathing Thickness	_____ in. $\geq$ 7/16" WSP
Roof Sheathing Fastening (Table 2)	_____

Notes:

- This checklist shall be met in its entirety, excluding the specific exception noted in 2, to comply with the requirements of 780 CMR 5301.2.1.1 Item 1. If the checklist is met in its entirety then the following metal straps and hold downs are not required per the WFCM 110 mph Guide:
 - Steel Straps per Figure 5
 - 20 Gage Straps per Figure 11
 - Uplift Straps per Figure 14
 - All Straps per Figure 17
 - Corner Stud Hold Downs per Figure 18a and Figure 18b
- Exception: Opening heights of up to 8 ft. shall be permitted when 5% is added to the percent full-height sheathing requirements shown in Tables 10 and 11.
- The bottom sill plate in exterior walls shall be a minimum 2 in. nominal thickness pressure treated #2-grade.
- From Tables 10 and 11 and location of wall sheathing and Building Aspect Ratio, determine Percent Full-Height Sheathing and Nail Spacing requirements

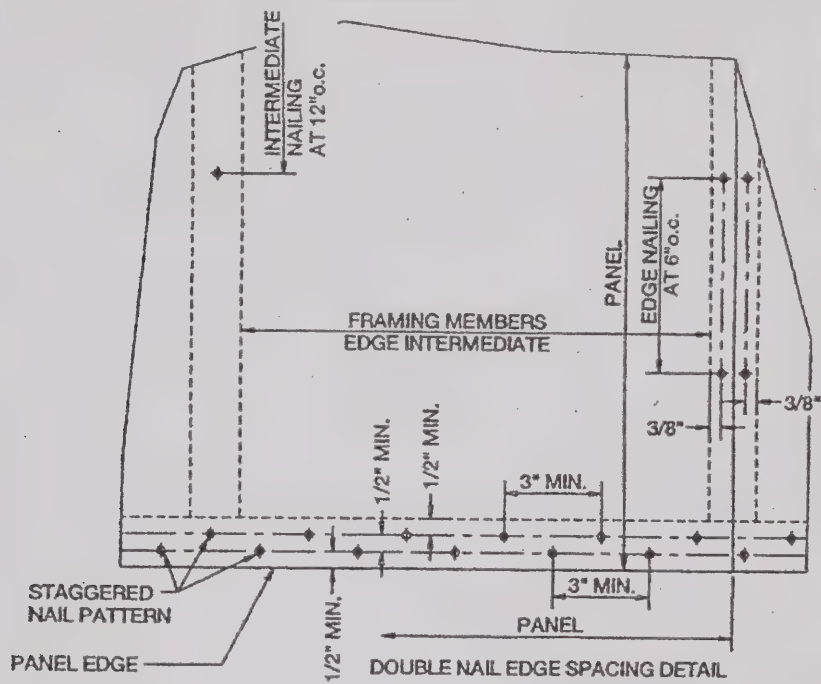
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- b. Wood Structural Panels shall be minimum thickness of 7/16" and be installed as follows:
- Panels shall be installed with strength axis parallel to studs.
 - All horizontal joints shall occur over and be nailed to framing.
 - On single story construction, panels shall be attached to bottom plates and top member of the double top plate.
 - On two story construction, upper panels shall be attached to the top member of the upper double top plate and to band joist at bottom of panel. Upper attachment of lower panel shall be made to band joist and lower attachment made to lowest plate at first floor framing.
 - Horizontal nail spacing at double top plates, band joists, and girders shall be a double row of 8d staggered at 3 inches on center per figures below : Vertical and Horizontal Nailing for Panel Attachment



See Detail on Next Page

Vertical and Horizontal Nailing
for Panel Attachment



Detail
Vertical and Horizontal Nailing
for Panel Attachment

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NON-TEXT PAGE

780 CMR 120.Q

RECOMMENDED FASTENING SCHEDULE

(Note: 780 CMR 120.Q is unique to Massachusetts)

Note: The applicable fastening schedules presented/referenced in 780 CMR 53.00 through 61.00 shall apply except that where fastening schedule information is not presented, the fastening schedule below shall then apply, unless fasteners are sized by a registered design professional.

780 CMR Table 120.Q1

RECOMMENDED FASTENING SCHEDULE

BUILDING ELEMENT	NAIL SIZE AND TYPE	NUMBER AND LOCATION
Stud to sole plate	8d common 16d common	4 toe-nail or 2 direct-nail
Stud to cap plate	16d common	2 toe-nail or 2 direct-nail
Double studs	10d common	12" o.c. direct
Corner studs	16d common	24" o.c. direct
Sole plate to joist or blocking	16d common	16" o.c.
Double cap plate	10d common	16" o.c. direct
Cap plate laps	10d common	2 direct-nail
Ribbon strip, 6" or less	10d common	2 each direct bearing
Ribbon strip, 6" or more	10d common	3 each direct bearing
Roof rafter to plate	8d common	3 toe-nail
Roof rafter to ridge	16d common	2 toe-nail or direct nail
Jack rafter to hip	10d common 16d common	3 toe-nail or 2 direct-nail
Floor joists to studs (No ceiling joists)	10d common 10d common	5 direct or 3 direct
Floor joists to studs (With ceiling joists)	10d common	2 direct
Floor joists to sill or girder	3d common	3 toe-nail
Ledger strip	16d common	3 each direct
Ceiling joists to plate	16d common	3 toe-nail
Ceiling joists (laps over partition)	10d common	3 direct-nail
Ceiling joists (parallel to rafter)	10d common	3 direct
Collar beam	10d common	3 direct
Bridging to joists	8d common	2 each direct end
Diagonal brace (to stud & plate)	8d common	2 each direct bearing
Tail beams to headers (When nailing permitted)	20d common	1 each end 4 sq. ft. floor area
Header beams to trimmers	20d common	1 each end 8 sq. ft. floor area
1" roof decking (over 6" in width)	8d common 8d common	2 ea. direct rafter 3 each direct rafter
1" subflooring (6" or less)	8d common	2 each direct joist
1" subflooring (8" or more)	8d common	3 each direct joist
2" subflooring	16d common	2 each direct joist
1" wall sheathing (8" or less in width)	8d common	2 each direct stud
1" wall sheathing (over 8" in width)	8d common	3 each direct stud
Plywood roof & wall sheathing (1/2" or less) (3/8" or greater) (5/16", 3/8", or 1/2") (3/8")	6d common 8d common 16 gauge galvanized wire staples, 3/8" minimum crown; length of 1" plus plywood thickness Same as immediately above	6" o.c. direct edges & 12" o.c. intermediate 6" o.c. direct edges & 12" o.c. intermediate 4" o.c. edges & 8" o.c. intermediate 2 1/2" o.c. edges & 5" o.c. intermediate
Plywood subflooring: (1/2") (3/8", 3/4") (1", 1 1/8") (1/2") (3/8")	6d common or 6d annular or spiral thread 8d common or 8d annular or spiral thread 10d common or 8d ring shank or 8d annular or spiral thread 16d galvanized wire staples 3/8" minimum crown, 1 3/8" length	6" o.c. direct edges & 10" o.c. intermediate 6" o.c. direct edges & 10" o.c. intermediate 6" o.c. direct edges & 6" o.c. intermediate 4" o.c. edges & 7" o.c. intermediate 2 1/2" o.c. edge 4" o.c. intermediate

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BUILDING ELEMENT	NAIL SIZE AND TYPE	NUMBER AND LOCATION
Built-up girders and beams	20d common	32" o.c. direct
Continuous header to stud	8d common	4 toe nail
Continuous header, two pieces	16d common	16" o.c. direct
¼" fiber board sheathing	1½" galvanized roofing nail or 16 gauge staple, 1½" long with min. crown of 7/16"	3" o.c. exterior edge 6" o.c. intermediate
25/32" fiber board sheathing	1¾" galvanized roofing nail or 8d common nail or 16 gauge staple, 1½" long with min. crown of 7/16"	3" o.c. exterior edge 6" o.c. intermediate
Gypsum sheathing	12 gauge 1¾" large head corrosion-resistant	4" o.c. on edge 8" o.c. intermediate
Particle board underlayment (¼"-¾")	6d annular threaded	6" o.c. direct edges 10" o.c. intermediate
Particle board roof and wall sheathing ½" or less	6d common	6" o.c. direct edges 12" o.c. intermediate
⅝" or greater	8d common	6" o.c. direct edges 12" o.c. intermediate
Particle board subflooring (⅝" or greater)	8d common	6" o.c. direct edges 12" o.c. intermediate
Shingles, wood ^a	No. 14 B&S Gage corrosion resistive	2 each bearing
Weather boarding	8d corrosion	2 each bearing

For SI: 1 inch = 25.4 mm, 1 square foot = 0.0929m²

Note a: Shingle nails shall penetrate not less than ¾" into nailing strips, sheathing or supporting construction except as otherwise provided in 780 CMR 1225.4.4.

**780 CMR TABLE 120.Q2
MAXIMUM SPACING OF GYPSUM WALLBOARD FASTENERS
(For nonfire-resistance rated construction assemblies)**

Thickness of gypsum wallboard (inch)	Plane of framing surface	Long dimension of gypsum wall-board sheets in relation to direction of framing members	Maximum spacing of framing members (center-to-center in inches)	Maximum spacing of fasteners (center-to-center in inches)		Nails to wood
				Nails	Screws	
½	Horizontal	Either direction	16	7	12	No. 13 gage, 1½" long, 19/54" head No. 098 gage, 1¼" long, Annular ringed 5d cooler nail
	Horizontal	Perpendicular	24	7	12	
	Vertical	Either direction	24	8	12	
⅝	Horizontal	Either direction	16	7	12	No. 13 gage, 1½" long, 19/64" head No. .098 gage, 1½" long, Annual ringed 6d cooler nail
	Horizontal	Perpendicular	24	7	12	
	Vertical	Either direction	24	8	12	
Fastening required with adhesive application						
½ or ⅝	Horizontal	Either direction	16	16	16	As required for ½" and ⅝" gypsum wallboard, see above
	Horizontal	Perpendicular	24	12	16	
2 layers each ⅝" (¾" total)	Vertical	Either direction	24			Base ply nailed as required for ½" gypsum wallboard and face ply placed with adhesive
	Vertical	Either direction	24	16	16	
	Horizontal	Perpendicular	24	24	24	
	Vertical	Either direction	24			

Note a. Where the metal framing has a clinching design formed to receive the nails by two edges of metal, the nails shall be not less than ⅝ inch longer than the wallboard thickness, and shall have ringed shanks. Where the metal framing has a nailing groove formed to receive the nails, the nails shall have barbed shanks or be 5d cooler nail (No. 13 ½ gage, 1½ inches long, 15/64 inch head) for ½ inch gypsum wallboard; 6d cooler (No. 13 gage, 1½ inches long, 15/64 head) for ⅝-inch gypsum wallboard.

Note b. Two nails at 2 inches to 2½ inches apart may be used if the pairs are spaced 12 inches center-to-center except around perimeters.

Note c. Screws shall be No. 6 with tapered head and long enough to penetrate into wood framing not less than ⅝ inch and metal framing not less than ¼ inch

Note d. All nails shall meet ASTM C514 or Federal Specification FF-N-105C.

Note e. For fire-resistance rated construction, see the pertinent fire test information.

Note f. 1 inch = 25.4 mm.

780 CMR TABLE 120.Q3

ALLOWABLE SHEAR FOR WIND OR SEISMIC FORCES IN POUNDS PER FOOT FOR VERTICAL

DIAPHRAGMS OF LATH AND PLASTER OR GYPSUM BOARD FRAME WALL ASSEMBLIES

Type of material	Thickness of Material	Wall Construction	Nail spacing maximum (in inches)	Shear value	Minimum nail size
Gypsum lath, plain or perforated	5/8" Lath and 1/2" Plaster	Unblocked	5	100	No. 13 gage, 1 1/8" long, 19/64" head, plasterboard blued nail.
Gypsum sheathing board	1/2" x 2' x 8' 1/2" x 4' 1/2" x 4'	Unblocked	4	75	No. 11 gage, 1 1/4" long, 7/64" head, diamond point, galvanized.
		Blocked	7		
		Unblocked			
Gypsum Wallboard or Veneer base	1/2"	Unblocked	7	2e+20	5d Cooler nails
			4		
		Blocked	7		
			4		
	5/8"	Blocked Two ply	4		6d cooler nails
			Base ply 9		
			Face ply 7		
					Base ply-6d cooler nails
					Face ply-8d cooler nails

Note a. These vertical diaphragms shall not be used to resist loads imposed by masonry or concrete construction. Values are for short time loading due to wind or earthquake and must be reduced 25% for normal loading

Note b. Applies to nailing at all studs, top and bottom plates and blocking.

Note c. Values shown are for gypsum board applied to one side only. The shear values may be doubled when identical materials are applied to both sides of wall

Note d. 1 inch = 25.4 mm.

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780 CMR 120.R

GUIDANCE FOR SELECTION OF
FOUNDATION MATERIAL CLASSES

120.R1.1 Purpose. The purpose of 780 CMR 120.R is to provide guidance for the selection of the material class and consistency in place when using Table 1804.3, Allowable Bearing Pressures for Foundation Materials.

120.R1.2 Application. 780 CMR 120.R is provided only as a general guide to engineering judgment. All available data should be evaluated and professional engineering judgment exercised in selection of the appropriate material classification for use with Table 1804.3. The references on soil and rock classification and typical ranges of index properties provided in this appendix should not be considered to be code requirements.

120.R1.3 Classification of Soil. Guidelines for

generally accepted engineering practice in the description and classification of soils are provided in ASTM D2488-84 Description and identification of Soils (Visual-Manual Procedure) and ASTM D2487-85 Classification of Soils for Engineering Purposes.

120.R1.4 Classification of Rock. Guidelines for generally accepted engineering practice in the description and classification of rocks are provided in Chapter 1 of Design Manual 7.1 - Soil Mechanics, Naval Facilities Engineering Command, May 1982 (NAVFAC DM-7.1)

120.R1.5 Typical Index Properties. Typical ranges of index properties for the Material Classes listed in Table 120.R1 are provided in Table 120.R2.

TABLE 120.R1 ALLOWABLE BEARING PRESSURES FOR FOUNDATION MATERIALS

Material Class	Description	Notes	Consistency in Place ¹	Allowable Net Bearing Pressure (tons/ft ²)
1a	Massive bedrock: Granite, diorite gabbro, basalt, gneiss	3	Hard, sound rock, minor jointing	100
1b	Quartzite, well cemented conglomerate	3	Hard, sound rock moderate jointing	60
2	Foliated bedrock: slate, schist	3	Medium hard rock, minor jointing	40
3	Sedimentary bedrock: cementation shale, siltstone, sandstone, limestone, dolomite, conglomerate	3, 4	Soft rock, moderate jointing	20
4	Weakly cemented sedimentary bedrock: compaction shale or other similar rock in sound condition	3	Very soft rock	10
5	Weathered bedrock: any of the above except shale.	3, 5	Very soft rock, weathered and/or major jointing and fracturing	8
6	Slightly cemented sand and/or gravel, glacial till (basal or lodgement), hardpan	7, 8	Very dense	10
7	Gravel, widely graded sand and gravel; and granular ablation till	6, 7, 8	Very dense Dense Medium dense Loose Very loose	8 6 4 2 Note 11
8	Sands and non-plastic silty sands with little or no gravel (except for Class 9 materials)	6, 7, 8, 9	Dense Medium dense Loose Very loose	4 3 2 Note 11
9	Fine sand, silty fine sand, and non-plastic inorganic silt	6, 7, 9	Dense Medium dense Loose Very loose	3 2 1 Note 11
10	Inorganic sandy or silty clay, clayey sand, clayey silt, clay, or varved clay; low to high plasticity	5, 6, 10	Hard Stiff Medium Soft	4 2 1 Note 11
11	Organic soils: peat, organic silt, organic clay	11		Note 11

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Notes for TABLE 120.R1:

1. Refer to 780 CMR 120.R2 regarding typical index test values that may be helpful as guides for evaluation of consistency in place.
2. Refer to 780 CMR 18.00 of the 6TH Edition Massachusetts Building Code for determination of design loads and for special cases.
3. The allowable bearing pressures may be increased by an amount equal to 10% for each foot of depth below the surface of sound rock; however, the increase shall not exceed two times the value given in the table.
4. For limestone and dolomite, the bearing pressures given are acceptable only if an exploration program performed under the direction of a registered design professional demonstrates that there are no cavities within the zone of influence of the foundations. If cavities exist, a special study of the foundation conditions is required.
5. Weathered shale and/or weathered compaction shale shall be included in Material Class 10. Other highly weathered rocks and/or residual soils shall be treated as soil under the appropriate description in Material Classes 6 to 10. Where the transition between residual soil and bedrock is gradual, a registered design professional shall make a judgment as to the appropriate bearing pressure.
6. Settlement analyses in accordance with 780 CMR 18.00 of the 6th Edition Massachusetts Building Code should be performed if the ability of a given structure to tolerate settlements is in question, particularly for, but not limited to, soft or very soft clays and silts and loose granular materials.
7. Allowable bearing pressures may be increased by an amount equal to 5% for each foot of depth of the bearing area below the minimum required in 780 CMR 18.00 of the 6th Edition Massachusetts Building Code; however, the bearing pressure shall not exceed two times the value given in the table. For foundation bearing areas having a least lateral dimension smaller than three feet, the allowable bearing pressure shall be $\frac{1}{3}$ of the tabulated value times the least dimension in feet.
8. Refer to 780 CMR 18.00 of the 6th Edition Massachusetts Building Code when these materials are used as compacted fills.
9. These materials are subject to the provisions in 780 CMR 18.00 of the 6th Edition Massachusetts Building Code for Liquefaction).
10. Alternatively, the allowable bearing pressure may be taken as 1.5 times the peak unconfined compressive strength of undisturbed samples for square and round footings or 1.25 times that strength for footings with length to width ratio of 4 or greater. For intermediate cases, interpolation may be used.
11. A registered design professional shall be engaged to provide recommendations for these special cases. Direct bearing on organic soils is not permitted. Organic soils are allowed under foundations for those cases defined in 780 CMR 18.00 of the 6th Edition Massachusetts Building Code, Preloaded materials.

TABLE 120.R2 TYPICAL RANGE OF INDEX PROPERTIES

Material Class	Description	Consistency in Place	Rock Quality Designation (RQD %)	Unconfined Compressive Strength (PSF)	Standard Penetration Resistance (Blows/Foot)
1a	Massive bedrock - granite, diorite, gabbro, basalt, gneiss,	Hard rock, minor jointing	>75	>8000	-
1b	quartzite, well-cemented conglomerate	Hard sound rock, moderate jointing	50 to 75		
2	Foliated bedrock	Medium hard rock minor jointing	>50	>8000	-
3	Sedimentary bedrock-cementation shale, silt-stone, sandstone, limestone, dolomite, conglomerate	Soft rock, moderate jointing	>50		-
4	Weakly cemented sedimentary bedrock - compaction shale or other similar rock in sound condition	Very soft rock	<50		
5	Weathered bedrock - any of the above except shale	Very soft rock, weathered and/or major jointing and fracturing	<50		-
6	Slightly cemented sand and/or gravel, glacial till (basal or lodgement), haropan	Very dense	-		>50
7	Gravel, widely graded sand and gravel, and granular abiation till	Very dense Dense Medium dense Loose Very loose	-		>50 41-50 16-40 8-15 <8
8	Sands and non-plastic silty sands with little or no gravel (except for Class 9 materials)	Dense Medium dense Loose Very loose	-		>30 11-30 6-10 <6
9	Fine sand, silty sand and non-plastic inorganic silt	Dense Medium dense loose Very loose	-		>30 11-30 6-10 <6
10	Inorganic sandy or silty clay, clayey sand, clayey slit, clay or varved clay low to high plasticity	Hard Stiff Medium Soft	-		>20 9-20 4-8 <4
11	Organic soils - peat organic silt, organic clay	-	-		-

Notes to TABLE 120.R2

Note 1: For discussion of RQD values see Deere, D.U., Rock Mechanics in Engineering Practice (Chapter 1), Stagg and Zinkiewicz, Eds., 1968, John Wiley and Sons, Inc.

Note 2: For determination of Unconfined Compressive Strength see ASTM D2938.

Note 3: For determination of Standard Penetration Resistance N-value see ASTM D1586. The presence of large particles (coarse gravel, cobbles, boulders) may cause N-values to be unrealistically high. Such values should not be used. Also standard penetration resistance should not be used over depths less than five feet.

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780 CMR 120.S**REFERENCE DATA FOR REPAIR, ALTERATION
AND CHANGE OF USE OF EXISTING BUILDINGS***(Note: 780 CMR 120.S is unique to Massachusetts)***120.S101.0 - PART ONE-GUIDELINES FOR
APPLICATION**

120.S101.1 Intent Relative to 780 CMR 34.00 and 93.00. The purpose of 780 CMR 120.S is to provide guidance to users of 780 CMR (the Massachusetts State Building Code) as to techniques of acceptable practice which can be used to assess the acceptability of various methods of meeting the intent of code provisions of 780 CMR 34.00 or 93.00 on a case-by-case basis. The purpose of the provisions in 780 CMR 34.00 and 93.00 and 780 CMR 120.S is to allow the repair, alteration addition, and change of use of existing buildings without requiring the entire building to be brought up to new construction requirements, while still providing for the public health, safety and general welfare. The provisions of 780 CMR 34.00 and 93.00 and 780 CMR 120.S recognize that the provisions of 780 CMR for new construction reflect the latest improvements in materials, construction techniques, standards of living and safety and, therefore, may preclude the repair, alteration, addition, or change of use of existing buildings that have demonstrated their usefulness and safety.

120.S102.0 SCOPE

120.S102.1 Techniques. 780 CMR 120.S is intended to demonstrate techniques of analysis and compliance with 780 CMR 34.00 in the repair, alteration, addition, and change of use of existing buildings.

120.S103.0 GENERAL CONDITIONS

120.S103.1 General Conditions. Conceptually, it is the intent of 780 CMR 34.00 and 93.00 and 780 CMR 120.S to allow repair, alteration, addition, or change of use of existing buildings without meeting all new construction requirements under the following general conditions:

1. all hazardous conditions must be corrected;
2. the existing building becomes the minimum performance standard; and
3. the degree of compliance of the building after changes must not be below that existing before the changes, except that nothing in 780 CMR 34 or 93 will require compliance with requirements more stringent than that required for new construction.

120.S104.0 IMPLEMENTATION

120.S104.1 Framework. Implementation of the above concept requires that a framework be established for evaluating the condition of the building; determining the potential for modification; and establishing the acceptability of proposed changes.

120.S104.2 Evaluation of Existing Building. Evaluation of existing conditions in a structure is required to determine the existence of any hazardous conditions, which must be corrected; and to provide a basis for evaluating the impact of the proposed changes on the performance of the building.

The following list of evaluation tools described in 780 CMR 120.S4.1.1 through 120.S4.2.7 can be used for determining the condition of the structure. However, this list is not necessarily complete and the use of other methods should not be precluded.

120.S104.2.1 Available Documentation of Existing Building. Prime sources of design information for existing buildings are the architectural and engineering drawings and specifications used in the construction of the building. Although the passing of time often obscures depositories of such documents, the following are likely prospects in attempting to locate such information:

1. If the building is currently in use, an individual or office responsible for its management may have retained drawings and specifications to facilitate maintenance. A building manager, resident engineer, superintendent, custodian, stationary engineer or plant engineer may be the most direct contact at the building site.
2. Other potential sources (especially if the building is not in use) include the original designer-architect or engineer.
3. The building department which issued the permit for construction may have documentation.
4. Documentation may have been retained by the general contractor or numerous sub-contractors; i.e.: the mason, carpenter, plumber, electrician, HVAC installer, steel erector, etc., as well as manufacturers of component parts, as potential sources of documentation.
5. In the case of large corporations or government agencies, a separate contracting officer may have developed a technical file on the erection of a building.

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6. In some cases, individual consultants are contracted to serve as "clerk-of-the-works" and pursue the inspection of a building project from start to finish with the keeping of a file likely.
7. Insurance companies sometimes maintain drawings or records of their insured buildings.
8. Historical or archaeological societies may have considered a building to be important enough to develop a file of documentation.

120.S104.2.2 Field Surveys. Having drawn upon available documentation to help evaluate a building's condition, such documentation may be augmented by on-site data acquired through field survey. The most obvious approach is to make use of detailed visual examination to confirm and/or alter any previously available information pertaining to the building.

120.S104.2.3 Testing. Testing is a tool that may be used in evaluating the condition of a building or structure or parts thereof when other methods of evaluation will not suffice. Testing may be initiated voluntarily on the part of the permit applicant or may be required by the building official in the absence of approved rules as indicated in 780 CMR 109.0, 116.0, and 780 CMR 34.00 and 93.00 when applicable. The costs of all such tests are to be borne by the permit applicant and should, therefore, be required by the building official only when other methods of evaluation prove inadequate or insufficient. Such testing should be conducted by an approved testing agency under the supervision of a registered architect or engineer. The report of the tests shall be submitted to the building official and shall include the details of test procedures, references to any accepted test standards used, the results of the tests and any conclusions drawn from the test results.

120.S104.2.4 Nondestructive Testing. This includes techniques where the structural integrity of the building is not affected, such as the following:

1. analyzing various portions of the building to determine dimensions, types and condition of materials, etc.;
2. portable apparatus for impact testing;
3. load application short of failure to determine capacity of materials and components;
4. magnetic methods for detecting flaws in ferrous metal;
5. proximity magnetometers (locating rebars in concrete, concealed ferrous fasteners, etc.);
6. electronic means for measuring the sonic modulus of elasticity of concrete and masonry in assessing its soundness;
7. ultrasonic transmission or reflective methods in detecting flaws in various materials; and

8. x-ray or infrared-ray photographic techniques used to evaluate portions of elements whose integrity is questionable.

120.S104.2.6 Destructive Testing. In destructive testing a sample of the building could be removed and tested (e.g., concrete core), or components of the building could be reconstructed and tested in the laboratory.

120.S104.2.7 Laboratory Analysis. In some cases, tests can be performed in the laboratory. Such tests might include the following:

1. chemical or metallurgical test;
2. optical or electronic microscopic examination which can help identify and evaluate the soundness of materials where decay or other molecular degradation is involved;
3. conventional laboratory tests for determining physical properties (strength, ductility, absorption, solubility, permeability, stiffness, etc.; and/or
4. testing of a scale model of the building (computer model, wind tunnel model, etc.).

120.S104.3 Evaluation of Change in Performance Level. It is necessary to determine if the level of performance of the building after alteration is below that which existed before the change. The hazard level could be increased for certain attributes (such as fire safety) while decreased for other attributes (such as floor loads) for a given alteration. The evaluation of the change in hazard levels of each attribute can be accomplished using various tools singly or in combination as described below in 780 CMR 120.S4.3.1 through 120.S4.3.5.

120.S104.3.1 Data on Archaic Systems. Performance data on architectural and structural systems encountered are tabulated in 780 CMR 120.S, Part Four. This data can be compared to the proposed altered systems to determine if the performance is adversely affected.

120.S104.3.2 Compliance Alternatives. Alternate solutions tabulated in 780 CMR 120.S, Part Two were developed from appeal data and from accepted practice. The list is not all-inclusive and should not preclude consideration of other alternatives.

120.S104.3.3 Analysis Methods. Analytical methods based on good engineering practice may be used to determine changes in performance levels.

120.S104.3.4 Test Methods. Test procedures as discussed in 780 CMR 120.S4.2.3 through 120.S4.2.6 can be used to evaluate the performance of existing construction.

120.S104.3.5 Professional Judgement. Professional judgement based on previous experience with similar buildings should be used to the fullest extent possible.

120.S201.0 - PART TWO - SUGGESTED COMPLIANCE ALTERNATIVES

120.S201.1 Purpose. The purpose of 780 CMR 120.S201.0 is to assist the building official and those regulated by 780 CMR in judging the acceptability of compliance alternatives to specific provisions required by 780 CMR.

120.S201.1.1 Application. 780 CMR 120.S202.0 contains generally acceptable compliance alternatives and examples. The examples are solely for the purpose of illustrating principles which can be applied to the solution of code compliance problems and are not necessarily acceptable under all circumstances. It is recognized that all building systems interact with each other. Therefore, any consideration of compliance alternatives must take into account all existing and proposed conditions to determine their acceptability. The principles applied can be used for the solution of similar compliance problems in other buildings and occupancy groups. Commentaries are provided where the philosophy in establishing the alternatives is not obvious. The examples were developed from appeal data and accepted practice. They are not all-inclusive and should not preclude consideration of other alternatives.

Note. It is anticipated that additional compliance alternatives will be added to 780 CMR 120.S202.0 through the mechanism of appeal decisions and from results of research being conducted by various organizations in the field of relative permanence of life safety systems.

120.S202.0 - COMPLIANCE ALTERNATIVES FOR EGRESS REQUIREMENTS

(Note that Compliance Alternatives May be Accepted by the Building Official or not Accepted)

120.S202.1 Number of Exits.

120.S202.1.1 General Compliance Alternatives:

1. Provide connecting fire balconies.
2. Provide alternate egress facilities.
3. Provide a fire escape.
4. Provide fire-rated areas of refuge.
5. Provide early fire detection.
6. Provide a fire suppression system.

120.S202.1.2 Examples:

Example 1 involves a five-story Building of Use Group B without a fire suppression system and with only one *means of egress*.

Solution A. Add one or more fire escapes as may be necessary to provide all tenants with reasonable access to two *means of egress* in separate directions. Access to a

street, public way or area of refuge shall be provided at the termination of the fire escape.

Solution B. Add connecting fire balconies across fire walls if the above solution is impractical due to construction difficulties.

Solution C. Introduce a fire sprinkler system.

Example 2 involves a building of Use Group R-2 occupancy with apartments in the basement. There is only one *means of egress* from the basement.

Solution A. Incorporate emergency escape and rescue systems into each basement apartment that comply with 780 CMR 10.00 of the 6th Edition State Building Code or of 780 CMR 53.00.

Solution B. Introduce a fire sprinkler system.

120.S202.2 Travel Distance.

120.S202.2.1 General Compliance Alternatives:

1. Add detection system.
2. Add a partial fire suppression system.
3. Add smoke doors.
4. Increase fire-resistance rating of corridor walls and doors.

120.S202.2.1 Example. This example involves a four story building of Use Group R-2 without a fire suppression system. The length of exitway access travel is 250 feet.

Solution A. Incorporate a fire suppression system for the building.

Solution B. Subdivide corridor into segments, if less than 100 feet, with smoke doors.

Solution C. If the building is pre-existing, non-conforming, install smoke and fire detectors with audible alarms in the corridor.

Solution D. Increase the fire-resistance rating of the exit access corridor from one hour to two hours and provide "B" label self-closing or automatic closing fire doors in all openings into the corridor.

120.S202.3 Enclosure of Exitways.

120.S202.3.1 General Compliance Alternatives:

1. Improve enclosure of exitway.
2. Incorporate a fire suppression system.
3. Add early notice fire detection system.

120.S202.3.2 Example. This example involves a four story row building of Use Group R-2 with connecting fire balconies and an interior stair. The stair is enclosed with lath and plaster, wood stud partitions and paneled doors.

Solution A. Cover partitions on the apartment side with $\frac{5}{8}$ inch Type X gypsum wallboard or its equivalent. Replace or build up panel doors until minimum solid portion is $1\frac{3}{4}$ inch and install self-closers.

Solution B. Provide a heat and smoke detection system in the stairwell with an alarm audible to all tenants. Provide self-closers on all stairwell doors.

Solution C. Provide a fire suppression system for the building. Provide self-closers on all stairwell doors.

120.S202.3.3 Commentary. The above example, while pertaining to a four story, Use Group R-2 building, can also be applied to other buildings of occupancies and floor levels. The principle that the degree of code compliance may not be reduced should be remembered. If the existing enclosure is of fireresistive construction, it must be maintained. The primary principle to remember, in the required enclosure of exitway, is that an enclosure must be provided, whether fireresistive or not, so as to provide a smoke barrier. The purpose of providing a smoke barrier is to prevent the passage of smoke from a fire on one floor to the exitways and exit access corridors of other floors and thus render them unusable for egress. This principle is illustrated by solutions A, B, and C in the above example.

120.S203.0 COMPLIANCE ALTERNATIVES FOR FIRE HAZARDS

120.S203.1 Fire Separations and Partitions.

120.S203.1.1 General Compliance Alternatives:

1. Improve fire separation.
2. Add a fire suppression system.
3. Add a detection system.

120.S203.1.2 Examples. Example 1 involves a three story building of Type 3A construction, containing a Mercantile (M) Use Group, on the first floor and occupancy Business (B) Use on the second and third floors. The required separation is three hours.

Solution A. Add a fire suppression system to the first and second floors.

Solution B. Add $\frac{5}{8}$ inch Type X gypsum wallboard or its equivalent to the underside of the second floor and install a system of smoke and heat detectors with audible alarms on the first and second floors.

Example 2 involves the separation between two tenants of wood lath and plaster on a wood studs partition. The required separation is one hour.

Solution A. Add $\frac{5}{8}$ inch Type X gypsum wallboard or its equivalent to either side of the

existing partition.

Example 3 involves a building of Use Group B with unrated exit access corridors.

Solution A. Install a partial fire suppression system in the exit access corridors.

Solution B. Add $\frac{5}{8}$ inch Type X gypsum wallboard or its equivalent to either side of the corridor partition and install self-closers on all corridor doors.

Solution C. Install a smoke and heat detection system in the corridor with and alarm audible to all tenants on the floor and install self-closers on all corridor doors.

120.S203.2 Openings and Exterior Wall Protection:

120.S203.2.1 General Compliance Alternatives:

1. Add fire suppression system.
2. Improve fireresistance.
3. Remove or improve openings.

120.S203.2.2 Examples. Example 1 involves a two story of Type 5B construction building, with Use Group M, on the first floor the basement and upper floors. The distance between the building and the side lot line is five feet and ten feet between it and the adjacent building. The adjacent building is of Type 5B construction and Use Group R-2. The former occupant was a grocery store; the new occupant is a hardware store.

Solution A. Install a deluge sprinkler system along the interior side of the wall affected.

Solution B. Add $\frac{5}{8}$ inch Type X gypsum wallboard to interior side of the wall affected.

Example 2 is the same as example 1 but with double-hung wood windows in affected wall.

Solution A. Remove windows and close opening with one hour fireresistive construction.

Solution B. Remove windows and install fire windows.

Solution C. Install a deluge sprinkler system as in solution A to example 1.

120.S301.0 - PART THREE - DETAILED CLASSIFICATION OF OCCUPANCY BY HAZARD INDEX NUMBER AND USE GROUP

120.S303.1 General. 780 CMR 120.S, PART THREE provides a more detailed guide for users of 780 CMR to determine hazard index numbers and use groups for various types of occupancies. 780 CMR 120.S supplements 780 CMR 3.00 and Table 780 CMR 3403.0 contained in 780 CMR 34.00.

Note 1. The Use Classifications and Hazard Indices shown below now reflect the Use Classifications and Hazard Indices of the Seventh (7th) Edition State Building Code which, in some instances, utilize a somewhat different Use Classification and Hazard Index classification than that of earlier Editions of the Massachusetts

State Building Code.

Note 2. The Use Classifications and Hazard Indices presented are representative only and property-specific conditions may result in different USE Classifications and resulting Hazard Indices.

TABLE 120.S1 HAZARD INDEX AND USE GROUP CLASSIFICATION

Use of Structure	Hazard Index No.	Use Group
Advertising Displays Manufacture including billboards	3	F-1
Airport or other aircraft landing or service facility (see also: Helicopter rooftop landing facility)	3	F-1
Amusement park, indoor	4	A-3
Animal		
Crematorium	2	B
Hospital, kennel, pound	2	B
Apartment (see Residences)		
Appliances		
Manufacture	3	M
Sales	3	M
Arenas	4	A-3
Asphalt		
Processing and products manufacture	8	H
Athletic equipment		
Manufacture	3	F-1
Sales	3	M
Auditoriums		
with stage	6	A-1
without stage	4	A-3
Automobile and other motor vehicles		
Gasoline service station	2	M
Rental agency within a building	2	B
Repair	3	S-1
Repair incidental to auto sales with limitation	2	B
Sales within a building	3	M
Wrecking	3	F-1B
Washing	2	
Awning manufacturer	3	F-1
Baked goods shop	3	M
Bakeries	3	F-1
Banks	2	B
Banquet halls	5	A-2
Barber shops	2	B
Beauty shops	2	B
Beverages		
Bottling	3	F-1
Manufacture		
Alcoholic (Up to and including 12% alcohol)	3	F-2
Alcoholic (above 12% alcohol)	8	H
Bicycle		
Manufacture	3	F-1
Rental or repair conducted within a building	3	S-1
Sales	3	M or S-1
Billiard Parlor	4	A-3

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TABLE 120.S1 HAZARD INDEX AND USE GROUP CLASSIFICATION - continued

Use of Structure	Hazard Index No.	Use Group
Blacksmith shops	3	F-1
Blueprinting, etc. establishments	2 or 3	B or S-1
Boarding house	4	R-1 or R-2
Boats or ships		
Building or repair of boats	3	F-1
Bowling alleys	4	A-3
Broom or brush manufacture	3	F-1
Building materials		
Wholesale business in roofed structures	3	M or S-1 or SPECIAL USE
Bus terminals or stations	4	A-3
Business schools or colleges	2 or other	B or dependent upon use
Camera and other photo equipment		
Manufacture except film sales	3	F-1
Sales	3	M
Canvas or canvas products		
Manufacture or repair	3	F-1
Carpet and rug		
Cleaning establishments	3	F-1
Manufacture or repair	3	F-1
Catering for outside consumption	3	F-1
Cemeteries		
Crematory in cemetery	3	F-1
Mausoleum, crypt, columbarium	1	S-2
Mortuary chapel in cemetery	4	A-3
Ceramics products manufacture, including pottery, small glazed tile and similar items	3	F-2
Charcoal, fuel, briquettes, or lampblack manufacture	8	H
Chemicals		
Packaging	8 or 3	H or F-1 or S-1 depending on nature of material
Manufacture	8 or 3	H or F-1 depending on nature of material
Churches or other places of worship	4	A-3
Circuses, temporary	4	A-3
Cleaning (see Drycleaning & dying; Laundries; Automobiles, washing)	3	F-1
Clothing		
Manufacture	3	F-1
Rental establishment		
Retail sales	2	B
Tailoring, custom manufacture or repair (see also Feathers; Felt; Fur; Leather)	3	F-1
Clubs		
Private	4 or 5	A-2 or A-3
Nightclubs (see Eating & drinking establishments)	5	A-2
Coal, coke or tar products		
Manufacture	8	H
Colleges and Universities		
Classroom buildings	2 or 4	A-3 or B
Dormitories	4	R-2
Fraternities or sororities	2 or 4	R-2 or R-3

TABLE 120.S1 HAZARD INDEX AND USE GROUP CLASSIFICATION - continued

Use of Structure	Hazard Index No.	Use Group
Community centers	4	A-3
Convalescent homes	4	I-1
Convents	2	R-2
Cosmetics or toiletries manufacture	3 or 8	F-1 or H
Cotton ginning	8	H
Cotton wadding or linters manufacture	8	H
Courthouses	2 or 4	B or A-3
Crematoriums		
Animal	2	B
Human	2 or 3	B or F-1
Dance halls	7	A-3
Day care centers	4	E or I-4
Dental offices (see Medical & dental)		
Department stores	3	M
Dormitories	4	R-1 or R-2
Dressmaking shops, custom	3	F-1 or M
Drinking places (see Eating & drinking establishments)		
Drug stores	3	M
Dry cleaning and dyeing establishments	2 or 4 or 8	B or F-1 or H depending on solvent used
Dwellings (see Residences)		
Eating or drinking establishments	5	A-2
Lunchrooms, restaurants, cafeterias, etc., primarily enclosed	4	A-2
Drive-in	5	A-2
With entertainment or dancing	5	A-2
Electric		
Power or steam generating plants	3 or 8	F-1 or H
Substation	3 or 8	F-1 or H
Electrical appliances, bulbs, wiring, supplies, etc.		
Manufacture	3	F-1
Sales	3	M
Electronic components & supplies		
Manufacture or repair	3	F-1
Feathers		
Curing, dyeing, washing or bulk processing	3 or 8	F-1 or H
Manufacturing exclusive of above	3 or 8	F-1 or H
Felt		
Curing, dyeing, washing or bulk processing	3 or 8	F-1 or H
Products manufacture, exclusive of above	3 or 8	F-1 or H
Fertilizer manufacture	8	H
Film, photographic, manufacture	3 or 8	F-1 or H
Storage and studios	2 or 3 or 8	B or F-1 or H
Fire stations	2	B
Fish processing	3	F-1
Food		
Product processing except meat & fish	3	F-1
Retail sales	3	M
Fraternities or sororities	2 or 4	R-1 or R-2 or R-3
Funeral establishments	4	A-3
Fur		
Curing, dyeing, finishing, tanning	3 or 8	H or S-1
Products manufacture exclusive of above	3 or 8	H or S-1
Garage (see Parking garage)		
Garbage incineration or reduction	3 or 8	F-1 or H

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TABLE 120.S1 HAZARD INDEX AND USE GROUP CLASSIFICATION - continued

Use of Structure	Hazard Index No.	Use Group
Gas		
Manufacture	3 or 8	F-1 or H
Public utility stations for metering or regulating	3 or 8	F-1 or H
Storage		
2500 cu. ft. or less	3	S-1
more than 2500 cu. ft.	8	H
Gasoline service station (see Automobiles)		
Gelatin manufacture	3	F-1
Generating plants, electric or steam	3 or 8	F-1 or H
Gift shops	3	M
Glass products from previously manufactured	3	S-2
Glue manufacture	3 or 8	F-1 or H
Golf		
Indoor courses or driving ranges	4	A-3
Gymnasiums (without spectator seating)	4	A-3
Grain storage	3 or 8	H or S-1
Hair		
Curing, dyeing, washing, bulk processing	3	F-1
Product manufacture exclusive of above	3	F-1
Hardware	3	F-1
Manufacture	3	M
Retail sales		
Helicopter landing facility, rooftop	3	S-1
Home occupations	2	B
Homes for the aged	4	I-2
Hosiery manufacture	3 or 8	F-1 or H
Hospitals		
Including convalescent, nursing, or rest homes and sanitariums, provided custodial care is not provided for drug addicts, alcoholics, mentally ill or mentally deficient	4	I-2
For care of drug addicts, mentally ill, or mentally deficient	4	I-2
Research or teaching laboratories (see also Animal hospitals)	2 or other	B or other
Hotels	4	R-1
Ice manufacturing (dry or natural)	3	F-1
Ice skating rinks	4	A-3 or A-4
Incineration or reduction of garbage, offal, or dead animals	3	F-1
Industry uses (see specific items)		
Without resulting noise, vibration, special danger, hazard, dust, smoke, fumes, etc.	3 or 8	F-1 or H
Other than above	Based on use.	Based on use.
Ink or inked ribbon manufacture	3	F-1 or H
Jewelry	3	F-1 or M
Kennels (see Animal)		
Laboratories		
Research laboratory not accessory to school or hospital	2 or 8	B or H
Scientific research or teaching laboratory, non-profit, accessory to school, or hospital, subject to limitations	2 or 8	B or H
Laundries		
Hand laundry	2	B
Self service; pick-up and delivery station of laundry or dry cleaner	2	B
Steam laundries without limitations	3	F-1

TABLE 120.S1 HAZARD INDEX AND USE GROUP CLASSIFICATION - continued

Use of Structure	Hazard Index No.	Use Group
Leather		
Curing, dyeing, finishing or tanning	3 or 8	F-1 or H
Product manufacture exclusive of above	3 or 8	F-1 or H
Libraries	4	A-3
Linoleum or oilcloth manufacture	3 or 8	F-1 or H
Liquor sales, package	3	M
Luggage manufacture	3	F-1
Lumber (see Wood)		
Manufacturing	3 or 8	F-1 or H
Matches manufacture	8	H
Mattress manufacture and renovation	3	F-1
Meat Markets	3	M
Slaughtering or packaging	3	F-1
Medical & dental offices	2	B
(see also Laboratories; Orthopedic & medical appliances; Hospitals)		
Meeting hall	4	A-3
Metals, manufacture	3	F-1
Reduction, refining or smelting	8	H
Monasteries	4	R2
Motels	4	R-1
Motor freight stations (see trucking terminals)		
Museums	4	A-3
Musical instruments manufacture	3	F-1
Newspaper publishing	3	F-1
Newsstands	3	M
Novelty products manufacture	3	F-1
Nursing Homes	4	I-2
Offices	2	B
Oilcloth manufacture	3	F-1
Optical equipment or similar precision instruments manufacture	3	F-1
Orphanages	3 or 4	I-1 or I-2
Orthopedic or medical appliance manufacture	3	F-1
Paint, turpentine or varnish		
Manufacture	8	H
Spraying booths	8	H
Paper products manufacture	3	F-1
Parish houses	4	A-3 or R-2
Parking garages	1	S-2
Petroleum or petroleum products		
Refining	8	H
Storage	3	S-1
Pharmaceutical products manufacture	3 or 8	F-1 or H
Photography studio	2	B
Plastics		
Product manufacture	8	H
Raw, manufacture	8	H
Police stations	2	B
Pool rooms	4	A-3
Post offices	2	B
Printing		
Plant	3	F-1
Printing or newspaper publishing	3	F-1
Prisons & other correctional or detention institutions	5	I-3
Pumping station or substation, water or sewage	3 or 8	F-1 or H

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TABLE 120.S1 HAZARD INDEX AND USE GROUP CLASSIFICATION - continued

Use of Structure	Hazard Index No.	Use Group
Radio		
Sales	3	M
Studios with audience	4	A-3 or A-4
Studios without audience	4	A-3
Railroad		
Freight terminal	3	S-1
Passenger station	4	A-3
Recreation		
Center, indoor	4	A-3
Community center building	4	A-3
Rectories	4	R-2
Residences		
One-family	2	R-3
Two-family	2	R-3
Apartment	2 or 4	R-2 or R-3
Temporary dwelling structure	4	R-1
Boarding or lodging house	4	R-1 or R-2
Dormitory	4	R-1 or R-2
Fraternity or sorority	2 or 4	R-2 or R-3
Hotel, motel apartment with accessory services	4	R-1
Convents, monasteries, rectories	2 or 4	R-2 or R-3
Research laboratories (see Laboratories)		
Restaurant, lunch room, cafeteria or other establishments primarily for eating	5	A-2
Retail business	3	M
Stores with combustible or flammable goods constructing a high hazard	8	H
Rubber		
Manufacture (natural or synthetic), including tires, tubes, or similar products	8	H
Products (exclusive or processing) including washers, gloves, footwear bathing caps and the like	3	S-1
Sanatariums		
Not providing custodial care for drug addicts, alcoholics, mentally ill, or mentally deficient	4 or 5	I-1 or R-2
Providing care for the above	4 or 5	I-1 or R-3
Schools (K-12)	4	E
Seminaries	2 or 4	R-2 or R-3
Sewage		
Disposal plant	3 or 8	F-1 or H
Pumping station	3 or 8	F-1 or H
Shoes		
Manufacture	3	F-1
Repair shop	3	F-1
Silverware manufacture, plate or sterling	3	F-1
Skating rinks	4	A-3 or A-4
Soap and detergents		
Manufacturing, including fat rendering	8	H
Packaging	3	F-1
Solvent extracting	8	H
Sporting or athletic goods		
Manufacture	3	F-1
Stores	3	M
Stables	3	S-1

TABLE 120.S1 HAZARD INDEX AND USE GROUP CLASSIFICATION - continued

Use of Structure	Hazard Index No.	Use Group
Stadiums	4	A-5
Wholesale business, including accessory storage other than flammable liquids, gases and explosives, in roofed structures	1 or 3	S-1 or S-2 or M depending on nature of materials
Stores (see Retail stores; or specific items)		
Tailor shops, custom	2	B
Tanning (see leather; Fur)		
Taxidermist shops	3	M
Telephone exchanges		
Automatic	2	B
Non-automatic	2	B
Television		
Sales	3	M
Studios	3 or 6	A-1 or A-3
Textiles		
Manufacture, including knit & yard goods, thread or cordage, spinning, weaving, dyeing & printing, shoddy manufacture	3	F-1
Theaters	6	A-1
Tires, manufacture	8	H
Tobacco products manufacture including curing	3	F-1
Tools & hardware		
Manufacture	3	F-1
Sales	3	M
Toys		
Manufacture	3	F-1
Trailer park (see Mobile homes)		
Truck		
Repairs	3	S-1
Sales	3	M
Trucking terminals	3	S-1
Turpentine manufacture	8	H
Warehouses	1 or 3 or 8	H or S-1 or S-2 depending on nature of materials
Waterpumping stations	3 or 8	F-1 or H
Wax products manufacture	8	H

120.S401.0 - PART FOUR - ARCHAIC CONSTRUCTION SYSTEMS

120.S401.1 Purpose. The purpose of 780 CMR 120.S401 through 120.S402, is to assist the building official and those regulated by 780 CMR in evaluating the properties of archaic construction systems.

120.S401.2 Scope. 780 cmr 120.S4 contains data on construction systems no longer in general use but which may be encountered in older existing buildings. It is meant to be used for assessing existing conditions when evaluating how proposed changes will impact upon the performance of the building.

120.S401.3 Application. In any given problem, all available data should be collected and professional judgement exercised in arriving at decisions.

Evaluative judgment should be used when test data does not exist or when applying the data contained in this standard.

120.S402.0 ARCHAIC FIRERESISTIVE SYSTEMS

120.S402.1 General. 780 CMR 120.S, Part Four contains a list of fireresistive materials and construction which are not necessarily currently in common use. Some of the hourly ratings contained in the listing predate ASTM E-119 that is in current use. The hourly ratings may be higher or lower if tested according to ASTM E 119. In addition to the data contained herein, see Report BMS92, Building Materials and Structures, dated October 7, 1942, National Bureau of Standards. The data listed below is extracted from the Boston Building Code, circa 1943.

120.S402.2 Fireresistive materials and construction.

120.S402.2.1 Minimum Qualities. Materials, to be given the fireresistive ratings specified in this part, shall have the following minimum qualities set forth in 780 CMR 120.S402.2.2 through 120.S402.2.19.

120.S402.2.2 Class 1 Concrete. Concrete of Class 1 shall be so proportioned as to have a strength of at least 1500 pounds per square inch (psi) and the coarse aggregate shall consist of limestone, trap rock, blast furnace slag, cinders containing not more than 20% of combustible material, burned clay or shale.

120.S402.2.3 Class 2 Concrete. Concrete of Class 2 shall be so proportioned as to have a strength of at least 1500 pounds psi, the coarse aggregate consisting of sandstone, granite, quartzite, siliceous gravel or other similar material not over one inch in size.

120.S402.2.4 Masonry. Masonry shall be laid in lime-cement or cement mortar, or approved masonry cement mortar, except that masonry of gypsum tile shall, and masonry of structural clay tile may, be laid in gypsum mortar. Masonry shall be thoroughly bonded by breaking joints in successive courses or by the use of metal ties.

120.S402.2.5 Brick. Brick shall be burned clay or shale, concrete or sand-lime brick of Grade C or better.

120.S402.2.6 Stone. Stone shall be limestone, marble, slate or equally fireresistive natural stone. Sandstone, granite or other stone which, because of its crystalline structure or for other reason, is less fireresistive, shall not be considered fire protection for structural metal, but may be used in a masonry wall not less than 12 inches thick required to have fireresistance. Stone masonry shall have the same fireresistive rating as brick masonry.

120.S402.2.7 Cast Stone. Cast stone masonry shall have the same fireresistive rating as brick masonry.

120.S402.2.8 Concrete Blocks. Concrete blocks, whether solid or hollow, shall have as coarse aggregate limestone, trap rock, blast furnace slag, cinders containing not more than 20% of combustible material, burned clay or shale.

120.S402.2.9 Structural Clay Tile. Structural clay tile shall conform to the specifications for load-bearing tile, floor tile or partition tile. Where partition tile is specified load-bearing tile may be used.

120.S402.2.10 Gypsum. Gypsum tile or pre-cast gypsum concrete, whether solid or hollow, shall conform to Standard Specifications for Gypsum

Partition Tile or Block of the American Society for Testing Materials and shall not contain more than 3% by weight of wood or other combustible binder or filler.

120.S402.2.11 Gypsum Concrete. Gypsum concrete shall not contain more than 12½ by weight of wood or other combustible binder or filler and shall have a compressive strength of at least 500 psi. It shall not be used where exposed to the elements.

120.S402.2.12 Lath. Expanded metal or wire lath as a base or reinforcement for plastering shall weigh not less than 2.2 pounds per square yard and shall have not less than 2½ meshes per inch.

120.S402.2.13 Metal Mesh for Masonry. Metal mesh reinforcement specified for masonry fire protection of structural metal shall consist of wire lath strips the full thickness of the masonry, laid in the beds thereof, or its approved equivalent.

120.S402.2.14 Metal Mesh for Concrete. Metal mesh reinforcement specified for concrete fire protection of structural metal shall consist of wire mesh weighing not less than 1½ pounds per square yard with wire spaced not over four inches, or not less than No. 11 gauge steel wire spaced not over four inches apart, or its approved equivalent.

120.S402.2.15 Cement Plaster. Cement plaster shall be proportioned of one part Portland cement, and not more than two parts of sand measured by volume dry and loose to which may be added lime putty or hydrated lime not exceeding 15% of the cement.

120.S402.2.16 Gypsum Plaster. Gypsum plaster, except where otherwise specified, may contain sand, not in excess of three times the weight of the gypsum.

120.S402.2.17 Lime plaster. Lime plaster shall consist of a mixture of one part lime, not over three parts sand, and water.

120.S402.2.18 Pneumatically Projected Mortar. Pneumatically projected mortar made of Portland cement, sand and water shall be rated for fire protection the same as Class 1 concrete.

120.S402.2.19 Concrete Fill. Concrete fill, where specified in 780 CMR 120.S in connection with hollow masonry units shall consist of Class 1 or Class 2 concrete poured in the hollow spaces of the units as they are laid.

120.S402.2.20 Reinforced Concrete. Portland cement concrete or gypsum concrete poured in place as fire protection for beams, trusses and other horizontal or inclined members of structural steel and pneumatically projected mortar applied to structural steel as fire protection shall be reinforced with metal mesh reinforcement. Concrete protection for vertical columns of structural metal shall have reinforcing consisting

of No. 5 wire spaced not over eight inches apart or its equivalent. Reinforcement shall be wrapped around the structural member and so arranged as to be completely embedded in the fire protection material and to ensure its integrity.

120.S402.2.21 Reinforced Plaster. Plaster used as fire protection or to resist the spread of fire shall be reinforced with metal lath, except plaster less than one inch thick or masonry or concrete.

120.S402.2.22 Replacement Material. In the protection of structural metal including reinforcement, ½ inch of cement or gypsum plaster may replace an equal thickness of poured concrete or pneumatically projected mortar as protective material; and one inch of cement or gypsum plaster reinforced with metal lath may replace an equal thickness of poured concrete, pneumatically projected mortar or masonry protection.

120.S402.2.23 Plaster. Where plaster is required without other specification, it shall consist of ½ inch of cement or gypsum plaster, except that only gypsum plaster shall be used on gypsum masonry.

120.S402.2.24 Thickness. In 780 CMR 120.S, except where otherwise specifically stated, the thickness given in a list of materials applies to the next following item only, and not to the total thickness where additional materials are specified.

120.S402.2.25 Embedding Limitations. Pipes, wires, conduits and ducts shall not be embedded in or placed behind the fire-protective materials required for the protection of structural steel or iron except as otherwise provided in this paragraph. Above fire-protective hung ceilings and within the enclosed space in buildings of Type 1 construction within which, other than the enclosure, fire protection of steel is not required, pipes, wires, conduits and ducts may be placed, provided they are so arranged and so secured that they will not, either by expanding in the event of fire, or otherwise impair, the effectiveness of the enclosing protective materials. Electric conduits and wires and gas pipes may be embedded in concrete or masonry fire protection of structural steel where the protective material is reinforced with wire mesh, provided they shall have protective covering except over the tops of beams and girders, at least as thick as required for the steel.

120.S5.2.7402.2.26 Damage Protection. In factories, garages, warehouses and other buildings in which the fire-protective covering required for steel or iron columns may be damaged by the movement of vehicles, materials or equipment, such covering shall be protected by metal or other material in a manner satisfactory to the building official.

120.S402.2.27 Firestopping. Firestopping shall mean the stopping off or enclosure at the ends and

wherever else specified of the spaced between studs of partitions, joists of floors and roofs and other similar spaces to prevent drafts of air and the communication of fire from one such space to another. Fire-stopping shall consist of wood not less than 1½ inches thick, of sheet metal not less than No. 24 gauge or of masonry, or a combination of such materials. Firestopping shall be tightly fitted in the space to be filled, about pipes, wires and ducts and, if cut or disturbed in the placement of pipes, wires and ducts, shall be repaired.

120.S402.3 Fire Protection of Steel Columns.

120.S402.3.1 Protective Thickness. Structural steel columns required to have fire protection of a given rating shall be covered on all sides with protective material having not less than the thickness necessary for the required rating. Except where "no fill" is specified, re-entrant and other accessible spaces behind the specified outer protection shall be filled with concrete or brick masonry or the material of the outer protection.

120.S402.3.2 Fireresistance Rating. Materials shall be assumed to afford to steel columns fire protection of the rating indicated in the following 780 CMR 120.S402.3.3 through 120.S402.3.6:

120.S402.3.3 Four Hour Rating:

1. Two inches Class 1 concrete.
2. Three inches Class 2 concrete, metal mesh reinforcement.
3. 3½ inches brick masonry.
4. Two layers two inch structural clay partition tile masonry, metal mesh in beds.
5. Two inches structural clay partition tile masonry, concrete fill, metal mesh in beds, ¾ inch gypsum plaster.
6. Four inches structural clay partition tile masonry, concrete fill, metal mesh in beds, ½ inch lime plaster.
7. Four inches structural clay partition tile or concrete block masonry, concrete fill, plaster.
8. Three inches hollow gypsum tile masonry and plaster.
9. Two inches gypsum concrete, metal mesh reinforcement.
10. Two inches solid gypsum tile masonry and plaster.
11. Three inches solid cinder concrete block masonry and plaster.
12. Four inches hollow cinder concrete block masonry and plaster.

120.S402.3.4 Three Hour Rating:

1. 1¼ inches Class 1 concrete.
2. Two inches Class 2 concrete, metal mesh reinforcement.

3. Two inches gypsum concrete.
4. Two inches solid cinder concrete block masonry and plaster.
5. Two inches structural clay partition tile masonry, concrete fill.
6. Four inches structural clay partition tile masonry, concrete fill, metal mesh in beds, $\frac{1}{2}$ inch lime plaster.

120.S402.3.5 Two Hour Rating:

1. $1\frac{1}{2}$ inches Class 1 concrete.
2. Two inches Class 2 concrete, metal mesh reinforcement.
3. One inch Class 1 or Class 2 concrete encased in standard weight steel or wrought iron pipe.
4. Two inches structural clay partition tile masonry and plaster.
5. Two layers plaster, each on metal lath, with $\frac{3}{4}$ inch air space between, two inches total thickness.
6. Two inches gypsum concrete.
7. Two inches solid or three inches hollow gypsum tile masonry.

120.S402.3.6 One Hour Rating:

1. One inch Class 1 concrete.
2. $1\frac{1}{2}$ inches Class 2 concrete with metal mesh reinforcement.
3. $2\frac{1}{4}$ inches brick masonry.
4. Two inches structural clay partition tile or concrete block masonry.
5. One inch cement or gypsum plaster on metal lath.

120.S402.3.7 Thickness. The thickness of protection on the outer edges of lugs or brackets need not exceed one inch.

120.S402.4 Fire Protection of Cast Iron Columns.

120.S402.4.1 Protective Thickness. Cast iron columns required to have fire protection of a given rating shall be covered on all sides with protective materials having not less than the thickness necessary for the required rating. Re-entrant spaces, if any on the exterior of cast iron columns, and other accessible spaces behind the specified protection, shall be filled with Class 1 concrete or brick masonry or the material of the outer protection.

120.S402.4.2 Fireresistance Rating. Materials shall be assumed to afford to cast iron columns fire protection of the rating indicating in 780 CMR 120.S402.4.3 through 120.S402.4.5:

120.S402.4.3 Four Hour Rating. Cast iron columns shall not be used where the protection of a four hour rating is required.

120.S402.4.4 Three Hour Rating:

1. Two inches Class 2 concrete.
2. Three inches Class 2 Concrete, metal mesh reinforcement.
3. Two inches structural clay partition tile or concrete block masonry concrete fill.
4. $1\frac{1}{2}$ inches cement or gypsum plaster on metal lath and metal furring to form $\frac{1}{2}$ inch air space.
5. $1\frac{1}{2}$ inches Class 1 concrete.
6. Two inches Class 2 concrete with metal mesh reinforcement.

120.S402.4.5 One Hour Rating:

1. One inch Class 1 concrete.
2. $1\frac{1}{2}$ inches Class 2 concrete with metal mesh reinforcement.
3. One inch cement or gypsum plaster on metal lath.

120.S402.5 Fire Protection of Steel in Reinforced Concrete Columns.

120.S402.5.1 Protection Thickness. The main steel reinforcement, including spiral reinforcement and ties larger than $\frac{1}{2}$ inch, in reinforced concrete columns required to have fire protection of a given rating shall be covered with concrete having not less than the thickness listed in 780 CMR 120.S402.5 for the rating indicating in the following 780 CMR 120.S402.5.2 through 120.S402.5.6.

120.S402.5.2 Four Hour Rating:

1. $1\frac{1}{2}$ inches Class 1 concrete.
2. Two inches Class 2 concrete.

120.S402.5.3 Three Hour Rating. $1\frac{1}{2}$ inches Class 1 or Class 2 concrete.

120.S402.5.4 Two Hour Rating:

1. One inch Class 1 concrete.
2. $1\frac{1}{2}$ inches Class 2 concrete.

120.S402.5.5 One Hour Rating. One inch Class 1 or Class 2 concrete.

120.S402.5.6 Ties less than $\frac{1}{2}$ Inch. The thickness of protection on column ties not larger than $\frac{1}{2}$ inch may be $\frac{1}{2}$ inch may be $\frac{1}{2}$ inch thinner than that listed above.

120.S402.6 Fire protection of Steel Beams, Girders, and Trusses.

120.S402.6.1 Protective Thickness. Steel beams, girders and trusses or the members of trusses, required to have fire protection of a given rating, shall be covered on all sides with material having not less than the thickness necessary for the required rating.

120.S402.6.2 Four Hour Rating:

1. Two inches Class 1 concrete.
2. Three inches Class 2 concrete.
3. Three inches structural clay partition tile or concrete block masonry and plaster.
4. Three inches hollow gypsum tile masonry and plaster.
5. Two inches gypsum concrete.
6. Two inches solid gypsum tile masonry and plaster.

120.S402.6.3 Three Hour Rating:

1. 1¾ inches Class 1 concrete.
2. 2½ inches Class 2 concrete.
3. Two inches gypsum concrete.
4. Two inches structural clay partition tile, or concrete block masonry and plaster.
5. Two inches solid, or three inches hollow gypsum tile masonry.

120.S402.6.4 Two Hour Rating:

1. 1½ inches of Class 2 concrete.
2. Two inches gypsum concrete.

120.S402.6.5 One Hour Rating:

1. One inch Class 1 concrete.
2. 1½ inches Class 2 concrete.
3. ¾ inch or cement or gypsum plaster on metal lath.

120.S402.7 Fire Protection of Steel in Reinforced Concrete Beams.

120.S402.7.1 Protective Thickness. The main steel reinforcement, including stirrups larger than ½ inch, in reinforced concrete beams, girders and trusses, including the ribs of reinforced concrete ribbed floors or roofs where one or both sides of the ribs, in addition to the soffit, are exposed to fire, required to have fire protection of a given rating, shall be covered on all sides with concrete having not less than the thickness listed in 780 CMR 120.S402.7 for the required rating. Where a reinforced concrete floor or roof has a flush ceiling formed with approved permanent masonry filler between ribs, the reinforcement shall have the protection required for reinforcing steel of floors and roofs in 780 CMR 120.S402.8.

120.S402.7.2 Four Hour Rating:

1. 1½ inches Class 1 concrete.
2. Two inches Class 2 concrete.

120.S402.7.3 Three Hour Rating. 1½ inches Class 1 or Class 2 concrete.**120.S402.7.4 Two hour rating:**

1. One inch Class 1 concrete.
2. 1½ inches Class 2 concrete.

120.S402.7.5 One Hour Rating. One inch Class 1 or Class 2 concrete.

120.S402.7.6 Stirrups less than ½ Inch. The thickness of protection on stirrups not larger than ½ inch may be less than that listed by not more than ½ inch.

120.S402.8 Fire Protection of Steel Reinforcing in Floors and Roofs.

120.S402.8.1 Protection Thickness. The steel reinforcement in reinforced concrete floors and roofs with flush or plane ceiling, such that the exposure to fire is on the soffit only, required to have fire protection of a given rating, shall be covered with concrete having not less than the thickness listed in 780 CMR 120.S402.8 for the required rating. In floors or roofs having reinforced concrete ribs where the concrete surrounding the steel reinforcement is exposed to fire on one or both sides in addition to the soffit, such reinforcement shall have the protection specified in 780 CMR 120.S402.7 for steel in reinforced concrete beams.

120.S402.8.2 Four Hour Rating:

1. One inch Class 1 concrete.
2. 1¼ inches Class 2 concrete.

120.S402.8.3 Three Hour Rating. One inch Class 1 or Class 2 concrete.**120.S402.8.4 Two Hour Rating:**

1. ¾ inch Class 1 concrete.
2. One inch Class 2 concrete.

120.S402.8.5 One Hour Rating. ¾ inch Class 1 or Class 2 concrete.**120.S402.9 Fireresistive Floor and Roof Construction.**

120.S402.9.1 Protective Thickness. Floors and roofs required to have resistance of a given rating to the spread of fire shall have such thickness of the materials of which it is constructed, as shall be necessary for the required rating, and structural metal forming a part of such floors or roofs shall have protection against fire of such required rating. Floors and roofs required to have two hour or longer resistance to fire be constructed of noncombustible materials. Granolithic, burned clay tile, ceramic tile or other similar incombustible floor finish of a given thickness may be substituted for an equal thickness, and sand, cinder or other incombustible filling material, with or without embedded wooden screeds, may be substituted for two thirds its thickness, of the floor or roof construction material specified in 780 CMR 120.S402.9, provided that such floors and roofs shall have adequate thickness for structural purposes.

120.S402.9.2 Fire Resistance Rating. Floor or roof construction shall be assumed to afford resistance to the spread of fire of the rating indicated in the following 780 CMR 120.S402.9.3 through 120.S402.9.6:

120.S402.9.3 Four Hour Rating:

1. Four inches solid slab of reinforced Portland cement concrete or reinforced precast gypsum concrete.
2. Four inches solid masonry arches or slabs.
3. Four inches structural clay floor tile masonry arches or slabs with top covering of not less than two inches of solid masonry or reinforced concrete.
4. Five inches combination reinforced Portland cement concrete slab consisting of permanent fillers of concrete block, gypsum or structural clay tile and 1½ inches of concrete topping; but if structural clay partition tiles are used for fillers, they shall be plastered on the soffit.

120.S402.9.4 Three Hour Rating:

1. Three inches solid slab of reinforced Portland cement concrete or reinforced precast gypsum concrete.
2. Three inches solid masonry arches or slabs.
3. Four inches structural clay floor tile masonry, arches or slabs with top covering of not less than 1½ inches of solid masonry or reinforced concrete.
4. Four inches combination reinforced Portland cement concrete slab consisting of permanent fillers of concrete block, gypsum or structural clay tile and one inch concrete topping; but if structural clay partition tiles are used for fillers, they shall be plastered on the soffit.

120.S402.9.5 Two Hour Rating:

1. 2½ inches solid slab of reinforced Portland cement concrete or reinforced precast gypsum concrete.
2. 2½ inches solid masonry arches or slabs.
3. Three inches structural clay floor tile masonry, arches or slabs with top covering of not less than one inch of solid masonry or reinforced concrete.

120.S402.9.6 One Hour Rating:

1. Three inches structural clay floor tile masonry, arches or slabs with all joints thoroughly filled with cement or gypsum mortar.
2. Wood floor or roof construction with joists not less than one and five eighths inches in least dimension, firestopped, double board floor, approved asbestos felt between lay of boards, and with a ceiling of at least ¾ inch cement or

gypsum plaster on metal lath.

3. Steel beams or steel joists not more than 36 inches apart on centers with noncombustible floor and a ceiling of at least ¾ inch cement or gypsum plaster on metal lath furring.

120.S402.10 Fire Resistive Ceiling Construction:

120.S402.10.1 Protective Thickness. Ceilings required to afford fire protection of a given rating to the floor or roof framing under which it is supported shall be of fire resistive materials of at least the thickness necessary for the given rating. A fire resistive ceiling and all hangers and fastenings necessary for its support to the protected framing shall be of noncombustible materials. It shall be capable of sustaining its own weight without exceeding allowable stresses. Metal reinforcement in such a ceiling shall be protected from fire as specified in 780 CMR 120.S402.8 for reinforcing in a floor.

120.S402.10.2 Fire Resistance Rating. Ceiling construction shall be assumed to afford to floor or roof framing fire protection of the rating indicated in the following 780 CMR 120.S402.10.3 through 120.S402.10.6.

120.S402.10.3 Four Hour Rating:

1. 2½ inches solid slab of reinforced Portland cement concrete or reinforced precast gypsum concrete.
2. Two inches precast reinforced gypsum concrete, plastered.

120.S402.10.4 Three Hour Rating:

1. Two inches solid slab of reinforced Portland cement concrete or reinforced precast gypsum concrete.
2. Two inches precast reinforced gypsum concrete, lapped or rabbeted joints.

120.S402.10.5 Two Hour Rating. 1½ inches solid slab of reinforced Portland cement concrete or reinforced precast gypsum concrete.

120.S402.10.6 One Hour Rating. ¾ inch cement or gypsum plaster on metal lath.

120.S402.11 Fire Resistive Bearing Walls and Partitions.

120.S402.11.1 Protective Thickness. Bearing walls and partitions required to have resistance to fire or the spread of fire of a given rating shall be constructed of fire resistive materials and shall have at least the thickness necessary for the required rating. Walls required to have two hour or longer rating shall be of noncombustible materials. Steel reinforcement in reinforced concrete walls shall have the same protection for the given rating as is required in 780 CMR 120.S402.9 for floors.

120.S402.11.2 Fireresistance Rating. Bearing walls and partitions shall be assumed to have resistance to fire and the spread of fire of the rating indicated in the following 780 CMR 120.S402.11.3 through 120.S402.11.6:

120.S402.11.3 Four Hour Rating:

1. Eight inches solid brick masonry.
2. 12 inches hollow wall of brick masonry, minimum eight inch masonry thickness.
3. 12 inches structural clay load-bearing tile masonry with two units and not less than three cells in the thickness of the wall.
4. Eight inches structural clay load-bearing tile masonry with one unit and not less than two cells in the thickness of the wall, plastered both sides.
5. 12 inches concrete block masonry with one unit and not less than two cells in the thickness of the wall.
6. Eight inches one piece concrete block masonry with shells and webs at least 1½ inches thick, plastered both sides.
7. 12 inches total thickness of brick masonry facing bonded to structural clay load-bearing tile masonry backing.
8. Eight inches solid concrete.
9. Six inches solid reinforced concrete.
10. A steel or reinforced concrete frame bearing wall in which the steel has fire protection of four hour rating, with panel filling as specified in 780 CMR 120.S402.12 for a nonbearing wall of four hour rating.

120.S402.11.4 Three Hour Rating:

1. Eight inches structural clay load-bearing tile masonry with two units and not less than four cells in the thickness of the wall.
2. 12 inches structural clay load-bearing tile masonry with one unit and not less than three cells in the thickness if the wall.
3. Eight inches one piece concrete block masonry with shells and webs not less than 1½ inches thick, plastered both sides.
4. Eight inches one piece concrete block masonry with shells and webs not less than two inches thick.
5. Five inches solid reinforced concrete.
6. A steel or reinforced concrete frame bearing wall in which the steel has fire protection of three hour rating, with panel filling as specified in 780 CMR 120.S402.12 for a nonbearing wall of three hour rating.

120.S402.11.5 Two Hour Rating:

1. Eight inches structural clay load-bearing tile masonry with not less than three cells in the thickness of the wall.

2. Eight inches concrete block masonry with shells and webs not less than 1½ inches thick.

3. A steel or reinforced concrete frame bearing wall in which the steel has fire protection of two hour rating, with panel filling as specified in 780 CMR 120.S402.12 for a nonbearing wall of two hour rating.

120.S402.11.6 One Hour Rating:

1. A steel or wooden stud bearing wall covered on both sides with one inch cement or gypsum plaster on metal lath, firestopped if of wood.
2. A steel or reinforced concrete frame bearing wall in which the steel has fire protection of one hour rating, with panel filling as specified in 780 CMR 120.S402.12 for a nonbearing wall of one hour rating.

120.S402.12 Fireresistive Nonbearing Walls and Partitions.

120.S402.12.1 Protective Thickness.

Nonbearing walls and partitions required to have resistance to fire and the spread of fire of a given rating shall be constructed of fireresistive materials and shall have at least the thickness necessary for the required rating. Walls required to have two hour or longer rating shall be of incombustible materials. Steel reinforcement in reinforced concrete walls shall have the same protection for the given rating as is required in 780 CMR 120.S402.8.

120.S402.12.2 Fireresistance Rating.

Nonbearing walls and partitions shall be assumed to have resistance to fire and the spread of fire of the rating indicated in the following 780 CMR 120.S402.12.3 through 120.S402.12.6.

120.S402.12.3 Four Hour Rating:

1. Eight inches solid brick masonry.
2. 3½ inches solid brick masonry, plastered both sides.
3. Six inches structural clay load-bearing tile, plastered both sides.
4. Six inches solid concrete.
5. Four inches solid reinforced concrete.
6. Any wall which, as a bearing wall, has a three hour or four hour rating in 780 CMR 120.S402.11, except the steel or reinforced concrete frame bearing wall.

120.S402.12.4 Three Hour Rating:

1. 3½ inches solid brick masonry.
2. Four inches structural clay load-bearing tile, plastered both sides.
3. Four inches solid concrete.
4. Three inches reinforced concrete.

5. Any wall which, as a bearing wall, has a two hour rating in 780 CMR 120.S402.11 except the steel or reinforced concrete frame bearing wall.

120.S402.12.5 Two Hour Rating:

1. Three inches gypsum tile masonry plastered both sides except in exterior walls.
2. Eight inches structural clay partition tile masonry, plastered both sides.
3. Eight inches structural clay load-bearing tile, with three cells in the thickness of the wall.
4. 2½ inches solid cement or sanded gypsum plaster on metal lath and noncombustible studding.
5. Three inches total thickness of hollow wall, ¾ inch cement or gypsum plaster on metal lath and noncombustible studding.
6. Three inches total thickness of hollow wall, ¾ inch cement or gypsum plaster on metal lath and wooden studding, firestopped.

120.S402.13 Fireresistive Doors.

120.S402.13.1 General. Doors which are required to be fire doors, fireresistive doors, or of fireresistive construction shall conform to the requirements of 780 CMR 120.S402.13 and 120.S402.14

120.S402.13.2 Classification. Fire doors shall be classified for the purposes of 780 CMR as Class A, Class B, and Class C.

120.S402.13.3 Class A Fire Doors. Class A fire doors shall be doors of the following construction and as specified in 780 CMR 120.S402.14:

1. Tin-clad, three ply wood core, sliding.
2. Tin-clad, three ply wood core, swinging single leaf, doorway not over six feet wide.
3. Tin-clad, three ply wood core, swinging in pairs, doorway not over feet wide.
4. Hollow metal, swinging single leaf, doorway not over four feet wide.
5. Hollow metal, swinging in pairs, doorway not over eight feet wide.
6. Sheet metal, sliding, single, doorway not over ten feet wide.
7. Sheet metal, sliding in pairs, doorway not over 12 feet wide.
8. Sheet metal, swinging single leaf, doorway not over feet wide.
9. Sheet metal, swinging in pairs, doorway not over ten feet wide.
10. Steel rolling doorway not over 12 feet wide.
11. Steel plate, doorway not over four feet wide.

12. Any other construction equal or superior to a tin-clad three ply wood core door in a standard fire test, for resistance to fire, the spread of fire and smoke, and transmission of heat.

120.S402.13.4 Class B Fire Doors. Class B fire doors shall be doors of the following construction and as specified in 780 CMR 120.S402.14:

1. Tin-clad, three ply wood core.
2. Tin-clad, two ply wood core, sliding, doorway not over ten feet wide.
3. Tin-clad, two ply wood core, swinging single leaf, doorway not over six feet wide.
4. Tin-clad, two ply wood core, swinging in pairs, doorway not over ten feet wide.
5. Hollow metal, sliding, doorway not over eight feet wide.
6. Metal-clad, paneled, swinging single leaf, doorway not over three feet wide.
7. Metal-clad, paneled, swinging in pairs, doorway not over six feet wide.
8. Any other construction equal or superior to a tin-clad two ply wood core door in a standard fire test, for resistance to fire, the spread of fire and smoke, and transmission of heat.

120.S402.13.5 Class C Fire Doors. Class C Fire doors shall be doors of the following construction and as specified in 780 CMR 120.S402.14:

1. Metal-clad, paneled, swinging single leaf, doorway not over four feet wide.
2. Metal-clad, paneled, swinging in pairs, doorway not over eight feet wide.

120.S402.13.6 Substitution. A Class A door may be used where Class B or Class C is specified; a Class B door may be used where Class C is specified. Two Class B or Class C doors on opposite sides of the wall may be used where a single Class A or Class B door is specified.

120.S402.13.7 Overlap. Fireresistive doors, when closed, shall completely cover the doorways in the walls and partitions or the openings in the floors or roofs to which they are fitted. A swinging fire door shall either overlap both jambs and the head of the opening not less than four inches or be fitted to a fireresistive frame with a rabbet the full thickness of the door and with not less than ½ inch overlap on the door. A sliding fire door, except in enclosures about passenger elevators, shall overlap both jambs and the head of the opening not less than four inches. A sliding fire door in an enclosure about a passenger elevator shall overlap jambs, head and adjoining panels not less than ½ inch. Fire doors shall fit closely at the floor with clearance of not over ¼ inch.

120.S402.13.8 Thresholds. In buildings with combustible floors, doorways required to have fire doors shall have noncombustible thresholds the

full thickness of the wall, extending at least four inches from the face of the wall where a door is hung and extending laterally at least six inches behind each jamb of the doorway. Thresholds may be flush with the floor.

120.S402.13.9 Rabbeted Frame. The rabbeted frame of a swinging fire door shall be constructed of structural steel built into the concrete, masonry or other fireresistive material of the wall about the opening and secured thereto, except that the rabbeted frame of a Class B or C door may be of wood, covered with sheet metal not less than No. 26 gauge in thickness, secured to the wall in the opening.

120.S402.13.10 Fit. Fire doors when closed shall fit tightly against the wall or frame so as to provide an effective stop for fire and smoke. Except for the metal-covered wooden frame specified in 780 CMR 120.S402.10, combustible material shall not intervene between the door and the fireresistive material of the wall, floor or roof to which it is fitted.

120.S402.13.11 Hardware. Hinge hardware for fire doors shall be of malleable iron or rolled structural steel not less than ¼ inch thick except that tubular steel track for sliding doors may be not less than ½ inch thick. Equivalent thickness of solid bronze or brass may be used. Fire doors shall not depend upon cords, cables or chains to support them in closed position except in elevator shafts.

120.S402.13.12 Tracks. Tracks for sliding fire doors shall be so supported that a track hanger comes at each door hanger when the door is closed. Track hangers shall be secured to wood stud walls by through bolts and to concrete walls by through bolts or approved built-in inserts. Expansion shields shall not be used to support fire doors.

120.S402.13.13 Hinges. Hinges for swinging fire doors, except in wooden stud walls, shall be riveted or through-bolted to the structural steel frame of the opening, through-bolted to the wall if of masonry or concrete or secured by approved inserts in the concrete or built into masonry in an approved manner.

120.S402.13.14 Strap Hinges. Strap hinges and sliding door hangers shall be secured to fire doors by through-bolting, riveting or welding. Swinging fire doors in rabbeted frames, except tin-clad, wood core doors, may be hung on butts. Other swinging fire doors shall have strap hinges.

120.S402.13.15 Straps, Locks and Latches. Sliding fire doors shall have adequate stops for the closed position. Swinging Class A fire doors shall have surface latches or unit locks. Class B and C doors shall have surface latches, unit or mortise locks. The latch bolts of unit or mortise locks on

fire doors shall have a throw of ¾ inch. When mounted in pairs, fire doors shall be rabbeted by means of an astragal or otherwise where they come together. One of a pair of swinging fire doors shall have push bolts at top and bottom with a throw of ¾ inch and the other shall be held by latch to the first.

120.S402.13.16 Opening Hardware. Except in detention buildings, fire doors hung in required exits shall be so fitted with hardware that they can be opened from inside without use of a key when the building is occupied.

120.S402.14 Fire Door Construction

120.S402.14.1 Fastening. In the construction of fire doors, solder shall not be used except for filling joints. Sheet metal shall be fastened to wood by nailing and to metal frame by bolting, riveting or welding.

120.S402.14.2 Glass. Class A doors shall not have glass panels. Class B doors may have glass panels not larger than 100 square inches in exposed area nor more than 12 inches in width or height. Class C doors may have glass panels not larger than 2,016 square inches in total exposed area, and any single light shall not have an exposed area exceeding 1,296 square inches. Glass in fire doors shall be wire glass not less than on quarter inch thick and shall be set ⅝ inch in grooves three quarters of an inch deep.

120.S402.14.3. Deleted

120.S402.14.4 Tin-clay, Two Ply. In-clad, two ply wood core doors shall be constructed in accordance with the specifications of the National Board of Fire Underwriters for such doors in Class B openings and shall bear the label of the Underwriters' Laboratories to this effect.

120.S402.14.5 Hollow Metals. Hollow metal doors shall have substantial stiles and rails of heavy pressed steel, reinforced for hinges and other hardware. Panels shall be of sheet filled with asbestos board or other approved insulating materials. The door shall be assembled by welding or riveting.

120.S402.14.6 Sheet Metals. Sheet metal doors shall be constructed with a rolled steel rigid frame covered both sides with ⅛ inch asbestos board and No. 26 gauge corrugated steel metal, with corrugations vertical on one side and horizontal on the other, bound on the edges with rolled steel or pressed steel shapes.

120.S402.14.7 Steel Rolling. A steel rolling fire door shall be constructed of sheet steel interlocking slats, sliding in grooves, counterweighted by springs, with the roller and mechanism enclosed in heavy sheet metal.

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120.S402.14.8 Steel Plate. A steel plate fire door shall be constructed of not less than No. 12 gauge steel plate mounted on a rolled steel frame, assembled by welding or riveting.

120.S402.14.9 Metal Clad. A metal clad, paneled fire door shall have a wood core with stiles and rails not less than 1¾ inches thick covered with No. 26 gauge sheet steel; panels ¾ inch thick covered with No. 26 gauge sheet steel, set ¾ inch in grooves; joints of metal lapped and well nailed.

120.S402.14.10 Class A Label. A door properly bearing the Underwriters' label certifying that it is suitable for the protection of a Class A opening shall be acceptable as a Class A door.

120.S402.14.11 Class B Label. A door properly bearing the Underwriters' label certifying that it is suitable for the protection of a Class B opening shall be acceptable as a Class B door, except that metal clad doors wider than three feet shall not be accepted as Class B doors.

120.S402.14.12 Class C Label. A door properly bearing the Underwriters' label certifying that it is suitable for the protection of a Class C opening shall be acceptable as a Class C door.

120.S402.15 Fireresistive Shutters. Shutters required to be fire shutters or fireresistive shutters shall be constructed and hung as specified for Class B fireresistive doors in 780 CMR 120.S402.13 and 120.S402.14.

120.S402.16 Fireresistive Windows.

120.S402.16.1 General. Windows which are required to be fire windows, fireresistive windows, or of fireresistive construction shall conform to the requirements of 780 CMR 120.S402.16.

120.S402.16.2 Moveable. Fireresistive windows may be fixed or arranged to open and close. Fixed fireresistive windows shall be so secured in the walls in which they are placed that they may expand in case of fire without buckling. Moveable fireresistive windows shall be opened or closed in one of the following manners:

1. One or more sashes may slide horizontally in a fireresistive frame.
2. One or more sashes may slide vertically with counterweights or with tow sashes counterbalanced and hung on chains. If a sash is closed in raised position, it shall have a fastening.
3. A sash may be hinged at top, bottom, or either side.
4. A sash may be pivoted at top and bottom or at the sides.
5. A sash may be arranged to open and close in any other approved manner, with approved

hardware.

120.S402.16.3 Sash. Moveable sashes in fireresistive windows shall be furred to fireresistive frames of the same or similar construction. Both sashes and frames, and metal mullions between window units, shall be so fitted in the walls in which they are placed as to be continuous with the fireresistive material of the wall and so secured that they may expand in case of fire without buckling.

120.S402.16.4 Glass. Glass in fireresistive windows shall be wired glass not less than one quarter inch thick and the area of a single light shall not exceed 720 square inches. Glass shall be set in three eighths inch grooves at least one half inch deep. Glass shall be secured by glazing angles or molding screwed to the sash and forming continuous grooves for the glass.

120.S402.16.5 Construction. Fireresistive windows shall be of the following construction:

1. Hollow sheet metal sashes and frames fabricated by pressing, welding, riveting or crimping without the use of solder or other fusible alloy, except for filling joints, and bearing the label of Underwriters' Laboratories.
2. Rolled steel or pressed steel sashes fabricated by pressing, welding, riveting or crimping, of a make and style approved by the commissioner.
3. Any other approved constructions as fireresistive as that specified in 780 CMR 120.S402.16.5 item.

120.S402.16.6 Hollow Sheet Metal. Fired fireresistive windows of hollow sheet metal construction shall not exceed seven feet in width not ten feet in height. Fireresistive windows of hollow sheet metal construction with moveable sashes shall not exceed six feet in width nor ten feet in height.

120.S402.16.7 Rolled Steel. Fireresistive windows of rolled steel construction shall not exceed 84 square feet in area not 12 feet in either height or width.

120.S402.16.8 Wind Pressure. Fireresistive windows and their fastenings shall be capable of resisting the wind pressure on the wall of the building applied either on the inside or the outside of the window exceeding allowable stresses.

120.S402.16.9 Substitution. Where fireresistive windows are required, wooden windows and plain glass may be substituted provided the openings are protected by fireresistive doors or shutters, or, in buildings of approved occupancy and construction, by an approved system of open sprinklers.

120.S402.17 Fireresistive Roof Covering.

120.S402.17.1 Classification. Roof covering allowed under this code shall be classified as fire-retardant or ordinary, according to resistance to fire outside, as provided in 780 CMR 120.S402.17. Fire-retardant roof covering is the more fireresistive and may be used where fire-retardant roofing is specified. Roof covering less fireresistive than ordinary roof covering shall not be used on any building.

120.S402.17.2 Fire-retardant Roofing. Fire-retardant roofing shall be any roof covering than meets the requirements of Class A or Class B roofing under the specifications of the Underwriters' Laboratories, Inc. The following roof covering shall be assumed to meet the requirements for fire-retardant roofing:

1. Built-up roofing consisting of successive layers of roofing felt impregnated with asphalt; a final layer of asphalt in which, while molten, is embedded a continuous layer of roofing gravel or slag.
2. Built-up roofing consisting of successive layers of roofing felt impregnated with coal tar; a final layer of tar in which, while molten, is embedded a continuous layer of roofing gravel or slag.
3. Built-up roofing consisting of successive layers of roofing felt impregnated with asphalt; a final layer of asbestos roofing felt impregnated with asphalt weighing not less than 14 pounds per 100 square feet, or a final layer of asphalt-saturated prepared roofing coated with granulated slate or other similar material.
4. Built-up roofing consisting of successive layers of roofing felt impregnated with tar or asphalt and a finish of burned clay floor tile, stone flagging, cement concrete or other similar material.
5. Sheet metal with locked and soldered joints not less than No. 26 gauge in thickness.
6. Shingles of natural slate.
7. Shingles of burned clay tile.
8. Shingles of sheet metal not less than No. 26 gauge in thickness.

9. Shingles of asbestos board not less than 1/8 inch thick.

10. Shingles of asphalt saturated felt surfaced with granulated slate or other similar material and carrying the Underwriters Class "C" label.

11. Corrugated sheet metal with lapped joints not less than No. 26 gauge in thickness.

12. Corrugated asbestos board not less than 3/16 inch thick.

120.S402.17.3 Ordinary Roofing. Ordinary roofing shall be of any roof covering which meets the requirements of Class C roofing under the specifications of the Underwriters' Laboratories, Inc. The following roof covering shall be assumed to meet the requirements for ordinary roofing:

1. Built-up roofing consisting of successive layers of roofing felt impregnated with asphalt, coal tar or other approved material, not equal in fireresistance to a fire-retardant roofing.
2. Prepared roofing consisting of felt or fabric impregnated or coated, or both, with asphalt, tar or other approved material or shingles of such prepared roofing, not equal in fireresistance to fire-retardant roofing.
3. Canvas stretched tightly and coated with paint.

120.S402.17.4 Means of Securing. Built up roofing shall be secured to the roof deck in the following manner:

1. Over masonry slab, the first layer shall be laid in molted asphalt or tar mopped on the roof deck, after the deck is properly primed, or by nailing a layer of building paper to nailing inserts other than wood placed in the deck.
2. Over wood decks, the built-up roofing shall be secured by nailing a layer of building paper to the roof deck over which the prepared roofing is to be laid with the first layer laid in molten asphalt or tar.
3. Roofings other than built-up roofings, such as shingles, slates, and tile roll roofing shall be well secured to the deck by nailing, bolting, wiring, or other approved methods.

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(PAGES 1091 THROUGH 1094 ARE RESERVED FOR FUTURE USE.)

780 CMR TABLE 120.T8
UNIT DESIGN DEAD LOADS FOR MATERIALS

Materials	Pounds per cubic foot
Cast stone masonry (cement, stone, sand)	144
Cinder fill	57
Concrete, plain:	
Cinder	108
Expanded slag aggregate	100
Haydite (burned clay aggregate)	90
Slag	132
Stone (including gravel)	144
Vermiculite and perlite aggregate, nonloadbearing	25-50
Other light aggregate, loadbearing	70-105
Concrete, reinforced:	
Cinder	111
Slag	138
Stone (including gravel)	150
Earth (dry)	96
Earth (damp)	108
Earth (wet)	120
Cork	15
Masonry, ashler:	
Granite	168
Limestone, crystalline	168
Limestone, oolitic	135
Marble	173
Sandstone	144
Masonry, rubble mortar:	
Granite	153
Limestone, crystalline	147
Limestone, oolitic	138
Marble	156
Sandstone	137
Rubble stone masonry	156
Terra cotta, architectural:	
Voids filled	120
Voids unfilled	72
Timber, seasoned:	
Ash, commercial white	41
Cypress, southern	32
Fir, Douglas, Coast region	34
Oak, commercial reds and whites	45
Redwood	28
Spruce, red, white, and Sitka	28
Southern pine, short leaf	39
Southern pine, long leaf	48
Timber, hemlock	30

For SI: 1 pound per cubic foot = 1602 kg/m³

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780 CMR TABLE 120.T9
UNIT DESIGN DEAD LOADS FOR ROOF AND WALL COVERINGS

ROOF AND WALL COVERINGS	POUNDS PER SQUARE FOOT
Asphalt shingles	2
Cement asbestos shingles	4
Cement tile	16
Clay tile (for mortar add 10 lb):	
2-inch book tile	12
3-inch book tile	20
Roman	12
Ludowici	19
Composition:	
Three-ply ready roofing	10
Four-ply felt and gravel	1
Five-ply felt and gravel	5½
Copper or tin	6
Corrugated asbestos cement roofing	1
Fiber board, ½ inch	1-3
Formed sheet steel	(see manufacturer)
Formed steel decking	2
Gypsum sheathing, ½ inch	¾
Rigid insulation, ½ inch	3
Sheet lead	8
Skylight, metal frame, ⅜-inch wired glass	7
Slate 3/16-inch	10
Slate ¼ inch	20
Spanish tile	
Wood sheathing, per inch thickness	3
Wood shingles	3

For SI: 1 inch - 25.4 mm, 1 pound per square foot = 47.88 Pa.

780 CMR TABLE 120.T10
UNIT DESIGN DEAD LOADS FOR SUSPENDED CEILINGS

SUSPENDED CEILINGS	POUNDS PER SQUARE FOOT
Cement on wood lath	12
Cement on metal lath	15
Gypsum on wood or metal lath	10
Plaster on tile or concrete	5
Suspended metal lath and gypsum plaster	10
Suspended metal lath and cement plaster	15
Plaster on wood lath	8

For SI: 1 inch - 25.4 mm, 1 pound per square foot = 47.88 Pa.

780 CMR TABLE 120.T11

UNIT DESIGN DEAD LOADS FOR UNPLASTERED WALLS AND PARTITIONS

Walls and partitions (unplastered)	Pounds per square foot
4 -inch clay brick, high absorption	34
4 -inch clay brick, medium absorption	39
4 -inch clay brick, low absorption	46
4 -inch sand/lime brick	38
4 -inch concrete brick, heavy aggregate	46
4 -inch concrete brick, light aggregate	33
8 -inch clay brick, high absorption	69
8 -inch clay brick, medium absorption	79
8 -inch clay brick, low absorption	89
8 -inch sand/lime brick	74
8 -inch concrete brick, heavy aggregate	89
8 -inch concrete brick, light aggregate	68
12 -inch common brick	120
12 -inch pressed brick	130
12 -inch sand/lime brick	105
12½ - inch concrete brick, heavy aggregate	130
12½ - inch concrete brick, light aggregate	98
17 -inch clay brick, high absorption	134
17 -inch clay brick, medium absorption	155
17 -inch clay brick, low absorption	173
17 -inch sand/lime brick	138
17 -inch concrete brick, heavy aggregate	174
17 -inch concrete brick, light aggregate	130
22 -inch clay brick, high absorption	168
22 -inch clay brick, medium absorption	194
22 -inch clay brick, low absorption	216
22 -inch sand/lime brick	173
22 -inch concrete brick, heavy aggregate	216
22 -inch concrete brick, light aggregate	160
4 -inch brick, 4 inch load bearing structural clay - tile backing	60
4 -inch brick, 8 inch loadbearing structural clay - tile backing	75
8 -inch brick, 4 inch loadbearing structural clay - tile backing	102
8 -inch combination brick and concrete block	72
12 -inch combination brick and concrete block	90
8 -inch loadbearing structural clay tile	42
12 -inch loadbearing structural clay tile	58
8 -inch concrete block, heavy aggregate	55
12 -inch concrete block, heavy aggregate	85
8 -inch concrete block, light aggregate	38
12 -inch concrete block, light aggregate	55
2 -inch furring tile, one side of masonry wall, - add to above figures	12
4 -inch hollow concrete block - stone aggregate	30
-lightweight	20
6 -inch hollow concrete block - stone aggregate	42
-lightweight	30
8 -inch hollow concrete block	55
-lightweight	38
10 -inch hollow concrete block - stone aggregate	62
-lightweight	46
12 -inch hollow concrete block - stone aggregate	85
-lightweight	55
4 -inch solid concrete block - stone aggregate	45
-lightweight	34
6 -solid concrete block - stone aggregate	50
-lightweight	37
8 -inch solid concrete block - stone aggregate	67
-lightweight	48
10 -inch solid concrete block - stone aggregate	84
-lightweight	52
12 -inch concrete block - stone aggregate	108
-lightweight	72

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Walls and partitions (unplastered)	Pounds per square foot
4 -inch loadbearing clay tile	24
6 -inch loadbearing clay tile	36
2 -inch nonloadbearing clay tile	11
3 -inch nonloadbearing clay tile	18
4 -inch nonloadbearing clay tile	20
6 -inch nonloadbearing clay tile	30
8 -inch nonloadbearing clay tile	36
10 -inch nonloadbearing clay tile	40
4 -inch nonloadbearing hollow concrete block	20
6 -inch nonloadbearing hollow concrete block	30
8 -inch nonloadbearing hollow concrete block	40
T.C. 1½-inch split terra cotta furring	8
2 -inch split terra cotta furring	10
3 -inch split terra cotta furring	12
2 -inch hollow gypsum block	9.5
3 -inch hollow gypsum block	10
4 -inch hollow gypsum block	15
5 -inch hollow gypsum block	18
6 -inch hollow gypsum block	24
2 -inch solid gypsum block	12
3 -inch solid gypsum block	18
4 -inch solid gypsum block	24
2 -inch facing tile	15
4 -inch facing tile	25
6 -inch facing tile	38
2 -inch solid plaster	20
4 -inch solid plaster	32
4 -inch hollow plaster	22
Wood studs 2x4, unplastered	4
Wood studs 2x4, plastered one side	12
Wood studs 2x4, plastered two sides	20
4 -inch glass block	18

For SI: 1 inch - 25.4 mm, 1 pound per square foot = 47.88 Pa.

**780CMR TABLE 120.T12
UNIT DESIGN DEAD LOADS FOR LATH AND PLASTER PARTITIONS**

Lath and plaster partitions	Pounds per square foot
2 -inch solid cement on metal lath	25
2 -inch solid gypsum on metal lath	18
2 -inch solid gypsum on gypsum lath	18
2 -inch metal studs, gypsum and metal lath both sides	18
3 -inch metal studs, gypsum and metal lath both sides	19
4 -inch metal studs, gypsum and metal lath both sides	20
6 -inch wood studs, plaster and wood lath both sides	18
6 -inch wood studs, plaster and metal lath both sides	18
6 -inch wood studs, plaster and plaster boards both sides	18
6 -inch wood studs, unplastered gypsum board both sides (dry wall)	10

For SI: 1 inch - 25.4 mm, 1 pound per square foot = 47.88 Pa.

**780 CMR TABLE 120.T13
UNIT DESIGN DEAD LOADS FOR PLASTER WORK**

Plaster Work	Pounds per square foot
Gypsum (one side)	5
Cement (one side)	10
Gypsum on wood lath	8
Gypsum on metal lath	8
Gypsum on plaster board or fiber board	8
Cement on wood lath	10
Cement on metal lath	10

780 CMR 120.U

INDEPENDENT STRUCTURAL ENGINEER REVIEW

(See 780 CMR 110.11 of the *Sixth Edition of the Massachusetts State Building Code*)

120.U101 Primary Structure: For the purposes of the independent structural engineering review, the primary structure shall be defined as the structural frame, the load supporting parts of floors, roofs, and walls, and the foundations. Cladding, cladding framing, stairs, equipment supports, ceiling supports, non-load bearing partitions, and railings are excluded from this definition of primary structure.

120.U102 Reviewing Engineer: The reviewing engineer shall be engaged by the owner.

120.U102.1 Qualifications: The reviewing engineer shall be a registered professional engineer, registered in Massachusetts, qualified by experience and training and who shall have had structural design experience with buildings or structures similar to that covered by the application for the building permit. The reviewing engineer shall be impartial, and shall be independent of the architect of record, structural engineer of record, and contractors and suppliers who will be involved in the construction of the structure.

120.U103 Criteria for Review: The reviewing engineer shall review the plans and specifications submitted with the application for the building permit for compliance with the structural and foundation design provisions of the Code. The reviewing engineer shall perform the following tasks:

1. Check to assure that the design loads conform with 780 CMR;
2. Check that other design criteria, and design assumptions, conform to 780 CMR and are in accordance with accepted engineering practice;
3. Review geotechnical and other engineering investigations that are related to the structural design to determine if the design properly incorporates the results and recommendations of the investigations;
4. Check that the organization of the structure is conceptually correct ; and
5. Make independent calculations for a representative fraction of systems, members, and details to check their adequacy. The number of representative systems, members, and details shall be sufficient to form a basis for the reviewer's conclusions.

120.U103.1 Structural Calculations: The structural calculations prepared by the structural engineer of record shall be submitted to the reviewing engineer, upon the reviewing engineer's request, for his or her reference only.

The reviewing engineer shall not be obligated to review or check these calculations. If the design criteria and design assumptions are not shown on the drawings or in the computations, the structural engineer of record shall provide a statement of these criteria and assumptions for the review.

120.U104 Structural Engineer of Record: The structural engineer of record shall retain sole responsibility for the structural design, and the activities and reports of the reviewing engineer shall not relieve the structural engineer of record of this responsibility.

120.U105 Report and follow-up:

1. The reviewing engineer shall prepare a report to the building official stating whether or not the structural design shown on the drawings and the specifications conform with the structural and foundation requirements of 780 CMR. Said report shall be based on the review as prescribed in 780 CMR 120.U and shall include a summary of all deficiencies, if any, which cannot be resolved with the structural engineer of record.
2. The structural engineer of record shall review the report of the reviewing engineer, and notify the building official in writing, whether or not he agrees with or disputes the conclusions and recommendations of the reviewing engineer.
3. Unresolved disputes between the structural engineer of record and the reviewing engineer shall be submitted by the building official, the owner, the structural engineer of record or the reviewing engineer to the Structural Peer Review Advisory Board for resolution.
4. Any changes to the structural design subsequent to the original submission of the plans and specifications shall be shown on revised drawings and specifications, submitted with an amendment to the application for permit. The reviewing engineer shall review the changes on the revised drawings and specifications, and, if the original report does not account for the changes in said drawings and specifications, a supplementary report relating to the changes and prepared by the reviewing engineer shall be made to the building official.

120.U106 Foundation Permits: When the plans and specifications are partially complete and an application is made for a foundation permit, the reviewing engineer may review the foundation plans and specifications on a conditional basis, provided that the reviewing engineer is given sufficient documentation so that he can perform 780 CMR 120.U103, Tasks 1, 2, 3, and 4 for the whole

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structure, and so that he can perform 780 CMR 120.U103, Task 5 for that part of the foundation covered by the application for foundation permit. The reviewing engineer shall prepare a report on that part of the foundation covered by the application for foundation permit, as prescribed in 780 CMR 120.U105, stating all conditions upon which the

report is based. When the reviewing engineer reviews the completed plans and specifications as prescribed in 780 CMR 120.U103, the reviewing engineer shall reperform Tasks 1, 2, 3, and 4, as necessary, to include all the revisions to the design subsequent to the application for the foundation permit.

780 CMR 120.V

ENERGY PROVISIONS

- For new construction one- and two-family dwellings and other low-rise residential buildings*, except hotels and motels, *see* 780 CMR 61.00.
- For existing one- and two-family dwellings and other low rise residential buildings, except hotels and motels, *see* 780 CMR 93.00.
- For new construction buildings other than low rise residential building, *see* 780 CMR 13.00
- For existing buildings, other than low-rise residential buildings, *see* 780 CMR 34.00.

* Low rise residential buildings are any residential use up to three stories in height, except hotels and motels.

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780 CMR 120.W

FLOOR PROTECTOR THERMAL CONDUCTIVITY CALCULATIONS

(Reference 780 CMR 60.00, as applicable, for solid fuel-burning appliances)

OVERVIEW

Floor protection requirements for heat producing appliances are typically included as part of the tested/listed installation criteria for such appliances.

Such floor protection, listed as a thermal conductivity factor is often developed utilizing NFPA SUBJECT 1618, *Outline of Investigation for Wall Protectors, Floor Protectors, and Hearth Extensions*. (Note that an NFPA SUBJECT is not treated nor maintained in the same manner as an NFPA standard).

When floor protection is developed utilizing NFPA SUBJECT 1618, or developed via "good Engineer-ing Practice", such methodology will typically estab-lish floor protection based on 3/8 inch millboard.

As the thermal conductivity of such millboard can vary from manufacturer to manufacturer, it will be necessary to obtain the thermal conductivity value from a specific manufacturer for a specific millboard product.

Typical thermal conductivity values can range from:

$$k = 0.21 \text{ (Btu) (inch) / (foot}^2\text{) (hour) (}^{\circ}\text{F)}$$

to

$$k = 0.84 \text{ (Btu) (inch) / (foot}^2\text{) (hour) (}^{\circ}\text{F)}$$

Thus the necessity for product specific thermal conductivity.

Note that the lower the algebraic value of "k", the lower the thermal conductivity and the less heat per given time that is transferred across the *floor protector*.

Note that in the following discussions it is necessary to maintain consistent dimensions - i.e.; in dealing with the thickness of materials, do not mix feet with inches, but rather keep all dimensions in inches.

COMPLIANCE

If the manufacturer of the appliance specifies an acceptable material and thickness for floor protection it is necessary, utilizing that specific material with specific thermal conductivity, k, to meet or exceed the thickness specified in order to assure compliance with the listed floor protection requirements of the appliance.

ESTABLISHING EQUIVALENCY

If it is determined that another material of different thermal conductivity is desired to be utilized for floor protection (i.e., perhaps for aesthetic reasons or in order to minimize the thickness of the floor

protector) and noting that the thermal conductivity, k, is linear as a function of thickness (for a given single material) then:

$$k_1/t_1 = k_2/t_2,$$

where:

k = thermal conductivity in

(Btu) (inch) / (foot²) (hour) (°F) and

t = thickness in inches

and therefore knowing any three of the variables of k and t allows one to solve for the remaining variable; i.e., :

Knowing k_1 , t_1 and t_2 , one can solve for k_2 :

$$k_2 = (k_1) (t_2)/(t_1)$$

Knowing k_1 , t_1 and k_2 , one can solve for t_2 :

$$t_2 = (k_2) (t_1)/(k_1)$$

COMPOSITE FLOOR PROTECTOR ASSEMBLIES

When an assembly consists of more than one material, the assembly is defined as a composite "material".

When a floor protector is constructed of more than one material; i.e., some form of backer board with decorative tile over, it is helpful to first establish the thermal resistance, r, of each material as thermal resistances may be directly added together and then convert the resulting total R to an equivalent thermal conductivity.

$$r = \text{(foot}^2\text{) (hour) (}^{\circ}\text{F)/(Btu) (inch) and;}$$

$$R = (r) (t)$$

where r is for a particular material in the composite and t is the thickness of that particular material.

Thus for the two-material example of backer board plus decorative tile,

$$R_{\text{total}} = R_{\text{backer Board}} + R_{\text{decorative tile}}$$

and;

$$R_{\text{backer board}} = (r_{\text{backer board}}) (t_{\text{backer board}})$$

and;

$$R_{\text{tile}} = (r_{\text{tile}}) (t_{\text{tile}})$$

RELATIONSHIP BETWEEN k AND R

By definition:

$$R = (1/k) (t) \text{ for each distinct material.}$$

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780 CMR 120.X

SCHEDULE OF FEES

120.X101 Fee Schedule: In accordance with the authority conferred by M.G.L. c 143, § 94, the State Board of Building Regulations and Standards hereby establishes the following fees as specified in 780 CMR Table 120.X101.

Exceptions:

1. Fees for projects which are under the jurisdiction of a city or town shall be as duly established by said city or town in accordance with 780 CMR

5114.

2. Fees for construction related licenses issued by a city or town shall be in accordance with fee schedules established by said city or town.

3. Fees for administrative appeals hearings in cities of towns having duly established building code appeals boards in accordance with 780 CMR 5122 shall be as established by said city or town.

780 CMR TABLE 120.X101

Fee Item	Period of Certification or Licensure	Fee (Dollars)	780 or M.G.L. Authority or Reference
Concrete Testing Laboratory			780 CMR 110.R1^a
Initial license	One year	150.00	780 CMR 110.R1.1.8
Renewal	One year	150.00	780 CMR 110.R1.1.10
Concrete Test Technician - Class A			780 CMR 110.R2^a
Initial license	One year	50.00	780 CMR 110.R2.1.9
Renewal	One year	50.00	780 CMR 110.R2.1.11
Initial license & Renewal Fees for employees of: municipalities, counties, Federal Government, Commonwealth of Massachusetts or any department, commission, agency or authority of, or created by the Commonwealth	One year	No Fee	780 CMR 110.R2.1.9
Examination	Per exam	Note 1	780 CMR 110.R2.1.7
Manufactured Buildings			780 CMR 110.R3^a
Manufacturer - initial certification (per system)	One year	1200.00	780 CMR 110.R3.18.1
Manufacturer -renewal of certification	One year	650.00	780 CMR 110.R3.18.3
Certificates\Labels per unit	Per label	50.00	780 CMR 110.R3.18.4
Replacement certificate\label	Per label	2.00	780 CMR 110.R3.18.4
Certificates\Labels per component	Per label	2.00	780 CMR 110.R3.18.4
Inspection Agency - initial certification	One year	500.00	780 CMR 110.R3.18.2
Inspection Agency - certification renewal	One year	500.00	780 CMR 110.R3.18.3
Registration of Producers of Native Lumber			780 CMR 110.R4^a
Initial registration fee	Two years	50.00	780 CMR 110.R4.1.4
Registration renewal	Two years	25.00	780 CMR 110.R4.1.5
Construction Supervisor License (CSL)			780 CMR 110.R5^a
Unrestricted license (any building enclosing up to 35,000 cubic feet of space)			
Initial license	Three years	150.00	780 CMR 110.R5.2.5
Renewal	Two years	100.00	780 CMR 110.R5.2.5
Examination fee	Per exam	Note 1	780 CMR 110.R5.2.5
Restricted License (one and two family dwellings)			
Initial license	Three years	150.00	780 CMR 110.R5.2.5
Renewal	Two years	100.00	780 CMR 110.R5.2.5
Examination fee	Per exam	Note 1	780 CMR 110.R5.2.5
Restricted License - Masonry only			
Initial license	Three years	150.00	780 CMR 110.R5.2.5
Renewal	Two years	100.00	780 CMR 110.R5.2.5
Examination fee	Per exam	25.00	780 CMR 110.R5.2.5

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780 CMR TABLE 120.X101 - continued

Fee Item	Period of Certification or Licensure	Fee (Dollars)	780 or M.G.L. Authority or Reference
Home Improvement Contractor Registration			M.G.L. c 142A & 780 CMR 110.R6 ^a
Initial Certification (applicants holding CSL License)	Two years	No fee	
Initial Application (all other applicants)	Two years	100.00	
Renewal (applicants holding CSL License)	Two years	No fee	
Renewal (all other applicants)	Two years	100.00	
Guaranty Fund Payment (upon initial registration - all applicants)			
0-3 employees	Note 2	100.00	
4-10 employees	Note 2	200.00	
11-30 employees	Note 2	300.00	
over 30 employees	Note 2	500.00	
Certification of Building Commissioners, Inspectors of Buildings and Local Inspectors.			M.G.L. c 143, § 3 & 780 CMR 110.R7 ^a
Certification fee		no fee	
Examination registration		Note 1	
Continuing education programs provided directly by the Board of Building Regulations and Standards		Reserved	
State Building Code Appeal Board			M.G.L. c 143, § 100
Administrative Hearing	Per hearing	150	780 CMR 122.3.1
Structural Peer Review Advisory Board			
Mediation Hearing		No fee	Not applicable to one- and two family dwellings
Building Permits and Construction Inspection for State Projects (except Massachusetts Bay Transportation Authority Projects) subject to 780 CMR and under the jurisdiction of the Department of Public Safety, Division of Inspections.			M.G.L. c 143, §§ 93 & 94 M.G.L. c 143 § 3A
Plans examination, construction inspection, issuance of building permit and certificate of occupancy	Per building or structure.	0.005 times the contract amount - minimum fee for a single project shall be \$25.00 (Note 3)	M.G.L. c 143, §§ 93 & 94
Note: This fee structure shall be deemed to include, but not be limited to, electrical, plumbing mechanical and fire protection work. Fees shall not be permitted to be levied by local jurisdictions.			
Massachusetts Bay Transportation Authority Projects			M.G.L. c 161A, § 18
Massachusetts Bay Transportation Authority Projects subject to 780 CMR.		No fee	M.G.L. c 161A, § 18
Periodic Inspections of Existing Buildings under the jurisdiction of the Division of Inspections, Department of Public Safety			780 CMR 106.5 & M.G.L. c 111
Hospitals and Clinics (certificate of inspection)			
First 100 beds	Two years	50.00	M.G.L. c 111, § 51
Each additional 25 beds	Two years	10.00	
Infirmarys; Convalescent Homes; Nursing Homes; Charitable Homes for the Aged; Rest Homes; Intermediate Care Facilities for the Mentally Retarded. (certificate of inspection)	Two years	50.00	M.G.L. c 111, § 71

780 CMR TABLE 120.X101 - continued

Fee Item	Period of Certification or Licensure	Fee (Dollars)	780 or M.G.L. Authority or Reference
Periodic Inspections of all other existing buildings.			M.G.L. c 143, § 94
Periodic inspections of specified use groups as specified by the <i>Sixth Edition of the Massachusetts State Building Code</i> .	As specified by 780 CMR	As specified by 780 CMR	
Certification of Building Commissioners, Inspectors of Buildings, and Local Inspectors			M.G.L. c.143, §§ 94 & 99 & 780 CMR 110.R7*
Certification Preparation Course of Instruction		zero - 500.00 See Note 4	M.G.L. c.143, §§ 94 & 99 & 780 CMR 110.R7 & the General Appropriation Act
Building Code Training			
One to Two Hour Session		zero - 25.00 See Note 4	"
½ Day Training Session		zero - 50.00 See Note 4	"
1 day Training Session		zero - 100.00 See Note 4	"
Multi Session Training		zero - 1000.00 See Note 4	"

a. Per the *Sixth Edition of the Massachusetts State Building Code*

Notes:

1. Examination fees established by examining institution.
2. M.G.L. c 142 A. § 11 provides that additional payments into the guaranty fund may be required if the fund administrator determines that the amount of the fund is insufficient to maintain it at a level commensurate with claims made against said fund.
3. Contract amount, for the basis calculation of permit fees, shall include the entire scope of work of the project and shall include all incidental constructions. Contract amount, for the basis of calculation of permit fees, shall not be deemed to include design fees or any other professional fees associated with construction observation or supervision or construction management.
4. Fees for continuing education of building officials and building code training will be established by the agency and may vary due to costs associated with each individual training session. Cost of materials, space rental, and contracted instructors, may influence fees.

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780 CMR 120.Y

HISTORIC STRUCTURES

Historic structures eligible for individual listing in the National Register of Historic Places, qualifying as totally preserved buildings (see 780 CMR 9309.0).

Acton	Faulkner Homestead, High Street	Duxbury	Gershom Bradford House, 931 Tremont Street
Agawam	Capt. Charles Leonard House, Main Street		King Caesar House, King Caesar Road
Amherst	Emily Dickinson Museum, 280 Main Street		Nathaniel Winsor House, 479 Washington Street
Amesbury	Rocky Hill Meetinghouse, Portsmouth Road	Gloucester	Beauport, Eastern Pt. Blvd. Hammond Castle, 80 Hesperus Avenue
Arlington	Fowle-Reed-Wyman House, 64 Old Mystic Street Jason Russell, 7 Jason Street Old Schwamb Mill, 17 Mill Lane	Hadley	Hadley Farm Museum, Russell Street Porter Phelps Huntinghouse, 130 River Drive
Barre	Barre Historical Society, Common Street	Haverhill	The Whittier House, 305 Whittier Road
Barnstable	Barnstable Custom House, Route 6A	Holyoke	Wisteriahurst, 238 Cabot Street
Bedford	Job Lane House, 295 North Road	Ipswich	Castle Hill, Argilla Road
Beverly	John Balch House, 448 Cabot Street Capt. John Cabot House, 117 Cabot Street Rev. John Hale House, 39 Hale Street	Lee	Merrell Tavern, Route 102
Boston	Gleason House, Beacon Street James Blake House, E. Cottage Street (Dor.) Clapp Houses, 105 Boston Street (Dor.) Loring-Greenough House, 12 South Street (JP) Old State House, 15 State Street Pierce House, 24 Oakten Avenue (Dor.) South End Historical Soc., 532 Mass. Avenue Isabella Stewart Gardner Museum, 280 The Fenway Nichols House, 55 Mt. Vernon Street	Lenox	Ventfort Hall, 104 Walker Street
		Lexington	Buckman Tavern, 1 Bedford Street Sanderson House, 314 Massachusetts Ave. Monroe Tavern, 1332 Massachusetts Ave. Hancock-Clarke House, 26 Hancock Street.
		Lincoln	The Grange, Codman Road
		Lowell	Whistler House, Worthen Street
		Lynn	Mary Baker Eddy House, 12 Broad Street
		Lynnfield	Meetinghouse
		Medford	Peak House, 347 Main Street
		Milton	Dr. Amos Holbrook House, 203 Adams Street Daniel Vose House, 1370 Canton Avenue
Boxford	Holyoke-French House, Elm Street Sylvanius-Thayer Birthplace, 786 Washington St	Nantucket	Whaling Museum, Broad Street Fire Hose Cart House, 8 Gardner Street Greater Light, 8 Howard Court Old Gaol, 15 Vestal Street 1800 House, 4 Mill Street Old Mill, 50 Prospect Street Hawden House, 96 Main Street Nathaniel Macy House, 12 Liberty Street Thomas Macy Warehouse, 10 Straight Wharf Fair Street Museum, 7 Fair Street Quaker Meeting House, 7 Fair Street
Brookline	Edward Devotion House, 347 Harvard Street		
Burlington	Francis Wyman House, Francis Wyman Road		
Cambridge	Cooper-Frost-Austin House, 21 Linnaean St.		
Charlton	Ryder Tavern, Stafford Street		
Chelmsford	Old Chelmsford Garrison House, 105 Garrison Road		
Chelsea	Gov. Bellingham-Cary House, 34 Parker Street		
Cohasset	Caleb Lothrop House, 14 Summer Street	New Bedford	Benjamin Rodman House, 50 North Second Street
Cummington	William Cullen Bryant Homestead, Bryant Road	New Salem	Whitaker-Clary House, Elm Street
Danvers	Fowler House, 166 High Street Rebecca Nurse House Glen Magna House	Newbury	Tristram Coffin House, 16 High Road Spencer-Pierce-Little House, Little Lane
Dennis	Josiah Dennis Manse, Nobscuset Road West Schoolhouse	Newton	Jackson Homestead, 527 Washington Street
		No. Andover	Parson Barnard House, Osgood Street
		No. Easton	Old Colony Railroad Station, Oliver Street
		Norwood	Fred Holland Day, 93 Bay Street

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Orleans	French Cable Station, Cove Road	<i>National Historic Landmarks</i>	
Oxford	Clara Barton Homestead, Clara Barton Road	Amesbury	John Greenleaf Whittier Home, 86 Friend Street
Peabody	Gen. Gideon Foster House, 35 Washington Street	Boston	African Meeting House, 8 Smith Court Nichols House, 55 Mt. Vernon Street Brook Farm, 678 Baker Street (Rox.) Christ Church, 191 Salem Street Faneuil Hall, Dock Square 1st Harrison Gray Otis House, 141 Beacon Street Paul Revere House, 19 North Street
Pittsfield	Herman Melville House, 78 Holmes Road	Concord	Ralph Waldo Emerson House, 28 Cambridge Tpk. The Old Manse Orchard House, 299 Lexington Road
Plymouth	Plymouth Antiquarian Society, 126 Water Street Harlow Old Ft. House, 19 Sandwich Street Pilgrim Hall, 75 Court Street Richard Sparrow House, 42 Summer Street	Dedham	Fairbanks House
Quincy	Adams Academy, 8 Adams Quincy Homestead, 34 Butler Street Josiah Quincy House, 20 Muirhead Street	Deerfield	Old Deerfield Village Historic District
Randolph	Johnathan Belcher House, 360 N. Main	Hancock	Hancock Shaker Village
Reading	Parker Tavern, 103 Washington Street	Harvard	Fruitlands, Prospect Street
Rockport	Old Castle, Castle Lane	Hingham	Old Ship Meetinghouse, Main Street
Salem	House of 7 Gables, 46-54 Turner Street Essex Institute, Essex Street The Norbone House Witch Museum Crowningshield Bently, Essex Street Gardner-Pingree House, 128 Essex Street Gedney House, 21 High Street Cox House, 19 High Street	Ipswich	John Whipple House, 53 S. Main Street
Sandwich	Hoxie House, 18 Water Street Eldred House, 4 Water Street Wing Fort House, Spring Hill Road	Lexington	Hancock Clarke House, 35 Hancock Street
Sheffield	Col. John Ashley House, Cooper Hill Road	Marblehead	Jeremiah Lee House, Washington Street King Hooper Mansion, Hooper Street
Shrewsbury	Gen. Artemas Ward Homestead, Main Street	Marshfield	Daniel Webster Law Office, Webster Street
Springfield	Alexander House, State Street George Walter Vincent Smith Art Museum	Medford	Peter Tufts House, 350 Riverside Drive Isaac Royal House, 15 George Street
Swansea	The Luther Store, 160 Old Warren Road The Martin House, 22 Stoney Hill Road	Milton	Capt. R. B. Forbes House, 215 Adams
Taunton Green	Old Colony Historical Society, 66 Church Parson Capen House	Nantucket	Nantucket Historic District Jethro Coffin House, Sunset Hill
Waltham	Robert Treat Paine House, 577 Beaver Street	New Bedford	New Bedford Historic District
Watertown	Edmund Fowle House, 26 Marshall Street	Newburyport	Caleb Cushing House, 98 High Street
Wenham	Claflin-Richard House, 132 Main	Quincy	John Adams Birthplace, 133 Franklin Street John Quincy Adams Birthplace, 141 Franklin Street
West Springfield	Josiah Day House, 70 Park Street	Salem	Peabody Museum The Custom House, 178 Derby Street
Weston	Gold Ball Tavern, Old Post Road	Saugus	Scotch Boardman House, 117 Howard Street
Woburn	Loammi Baldwin Mansion, 2 Alfred Street	Stockbridge	Chesterwood, Williamsville Road The Mission House, Main Street
Wilmington	Harden Tavern, 436 Salem Street	Waltham	The Vale, Lyman Street Gore Place, 52 Gore Street
Worcester	Timothy Paine House, 140 Lincoln Street	Woburn	Count Rumford Birthplace, 90 Elm Street
		Worcester	American Antiquarian Society, 185 Salisbury Street

Historic structures determined eligible for listing in the National Register of Historic Places not qualifying as totally preserved buildings (see Partially preserved buildings, 780 CMR 3409.0). Refer to:

1. National Register of Historic Places,
U.S. Federal Register, February 1, 1978, Part II.
2. National Register of Historic Place (additions).
Contact the Massachusetts Historical Commission at the Massachusetts Archives Building, 220 Morrissey Boulevard, Boston, MA 02125.

Historic districts listed in the National Register of Historic Places. Refer to:

1. National Register of Historic Places,
U.S. Federal Register, February 1, 1979, Part II.
2. National Register of Historic Place (additions).
Contact the Massachusetts Historical Commission at the Massachusetts Archives Building, 220 Morrissey Boulevard, Boston, MA 02125.

Structures proposed for certification as partially preserved not listed in the national register of historic places. Refer to Massachusetts Historical Commission Inventory Forms.

Contact the Massachusetts Historical Commission at the Massachusetts Archives Building, 220 Morrissey Boulevard, Boston, MA 02125.

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APPENDIX 120.Z

DESIGN AND CONSTRUCTION OF TOWNHOUSES

(Note: 780 CMR 120.Z is unique to Massachusetts)

780 CMR 120.Z101 GENERAL

120.Z101.1 Scope. The provisions of 780 CMR 120.Z shall govern the design, construction, repair, renovation, alteration, addition, demolition and change of use to *townhouses*.

780 CMR 120.Z102 DEFINITIONS

120.Z102.1 General. The following words and items shall, for the purposes of 780 CMR 120.Z and as used elsewhere in 780 CMR, have the meaning shown in 780 CMR 120Z102.

TOWNHOUSE. *A single family dwelling unit constructed in a group of three or more attached units in which each unit extends from foundation to roof and with open space on at least two sides (Use classification is typically R-2 by nature of numbers of and nature of occupancy of dwelling units per 780 CMR 3.00). Note; Townhouses ("row housing") in Massachusetts, unlike one- and two-family dwellings, are subject to seismic design requirements but townhouses of no more than three stories in height are allowed, in certain other respects, to resemble one- and two-family homes.*

LOW-RISE RESIDENTIAL BUILDINGS. *Any Residential use of up to three stories in height above grade, except hotels and motels.*

780 CMR 120.Z103 BUILDING PLANNING
FOR TOWNHOUSES

120.Z103.1 Design and Construction. For design and construction purposes, *townhouses* shall be

designed and constructed in accordance with the applicable requirements of 780 CMR 1.00 through 50.00: *The Massachusetts State Building Code, 7th Edition*, as applicable). The height and area restrictions of 780 CMR 5.00 generally and of 780 CMR T503, specifically, shall likewise apply.

Exception 1. Energy conservation requirements for any new construction *low-rise residential building* including townhouses of no more than three stories in height (except hotels and motels) shall comply with the requirements of 780 CMR 61.00: *Energy Efficiency* of the Massachusetts Building Code for One- and Two-Family Dwellings, 7th Edition.

Exception 2. For townhouses of no more than three stories in height, fire separation requirements between dwelling units shall comply with the requirements of 780 CMR 5302 of the Massachusetts Building Code for One- and Two-Family Dwellings or the fire separation requirements dictated by the building Construction Type, whichever is greater.

Exception 3. For townhouses of no more than three stories in height, all required means of egress elements, including, but not limited to stair design and allowed widths, stair rise and run, hand rails and guardrails and required landings may comply with requirements of 780 CMR 51.00 through 100.00, as applicable. For townhouses of more than three stories in height the applicable egress element requirements of 780 CMR 1.00 through 50.00, are required.

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